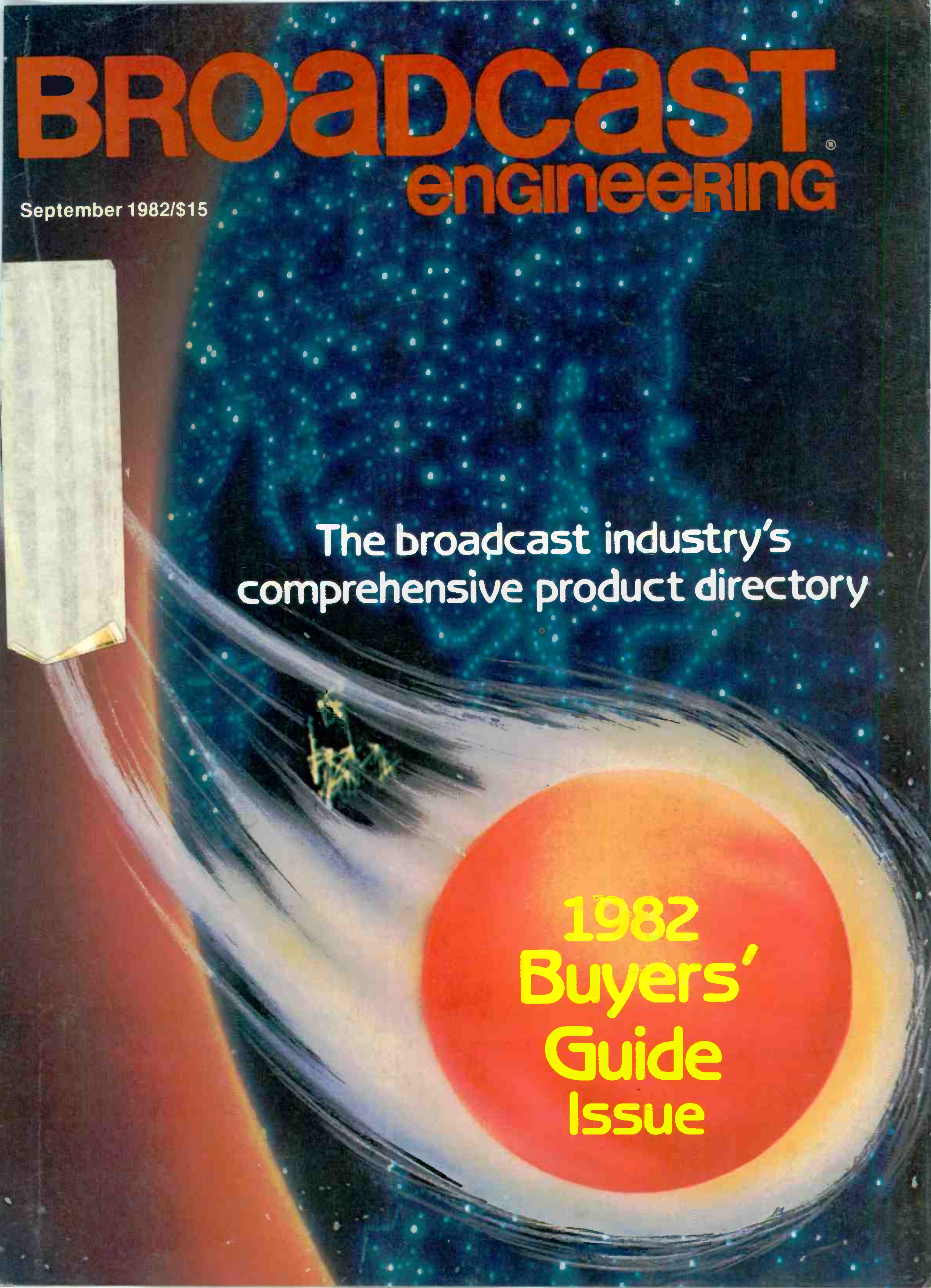
BROADCAST engineering

September 1982/$15



The broadcast industry's comprehensive product directory

1982 Buyers' Guide Issue

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BROADCAST engineering

The journal of broadcast technology

September 1982 • Volume 24 • No. 9

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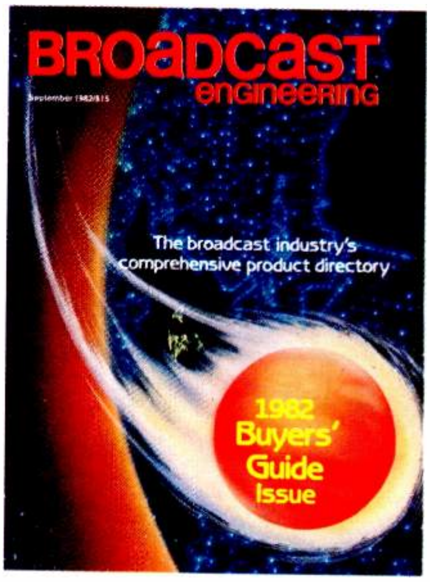

THE COVER for the annual *Buyers' Guide,* traditionally, is a challenge for our editors and artists. Each year we try to find a way to capture the interests of both our radio and TV readers with the cover of our September issue. It is a tough assignment, and we welcome suggestions from anyone who thinks they might have an idea that will accomplish our goal.

This year, however, we elected to sidestep the issue! The cover has nothing to do with broadcasting. It is simply a colorful piece of art generated via computer. The original photograph was supplied by Digital Effects in New York City. Graphic design was provided by Kim Nettie.

COMING EVENTS...

Sept. 30-Oct. 2
RTNDA International Conference, Ceasars Palace, Las Vegas, NV.

Oct. 1-3
LPTV East Conference, Shoreham Hotel, Washington, DC.

Oct. 11-13
National Cable Television Association Business Development Symposium, Washington Marriott, Washington, DC.

Oct. 11-13
Electronic Industries Association 58th Annual Conference, Century Plaza Hotel, Los Angeles.

Oct. 19-20
Public Service Satellite Consortium Seventh Annual Conference, Washington Hilton, Washington, DC.

OCTOBER ISSUE:

- Third annual engineering/management salary survey
- Standards conversion for TV
- Wireless and professional mics

"I want the world. Consistent .05% corner registration and full auto-setup of up to 96 cameras on computer command."

HITACHI HEARD YOU.

AUTO SETUP

Don't want much, do you?

Dynamic registration not just at dead center but at all four corners. Plus 2-minute auto-setup of all those cameras.

You're asking for some smart camera system, networks of the world and top-drawer video production companies.

Well, Hitachi heard you, and has created an outright *genius*—the Hitachi SK-110 Camera System.

The computer registration capabilities of this camera system produce pictures of a clarity and resolution previously unheard of.

And you get auto-setup at the push of just one button, and zero reference, too, where the computer sets the green channel and compares blue and red to it with absolute precision.

The SK-110 is not only self-correcting, but self-diagnostic as well. It gives both video screen display and hard copy printout; can be hooked into the CRT for control room monitoring.

There's a high-performance contour corrector; 5 automatic setup modes including quick check; 5 data files; so many other unique features an ad can't begin to tell you about them.

The ultimate Hitachi SK-110. Contact the broadcast video division at any of the offices listed below. Hitachi Denshi America Ltd., 175 Crossways Park West, Woodbury, NY 11797 (516) 921-7200. Offices also in Chicago (312) 344-4020; Los Angeles (213) 538-4880; Atlanta (404) 451-9453; Cincinnati (513) 489-6500; Dallas (214) 233-7623; Denver (303) 344-3156; Seattle, (206) 575-1690; and Washington, D.C. (301) 459-8262.

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BROADCAST ENGINEERING is edited for corporate management, engineers/technicians and other station management personnel at commercial and educational radio and TV stations, teleproduction studios, recording studios, CATV and CCTV facilities and government agencies. Qualified persons also include consulting engineers and dealer/distributors of broadcast equipment.

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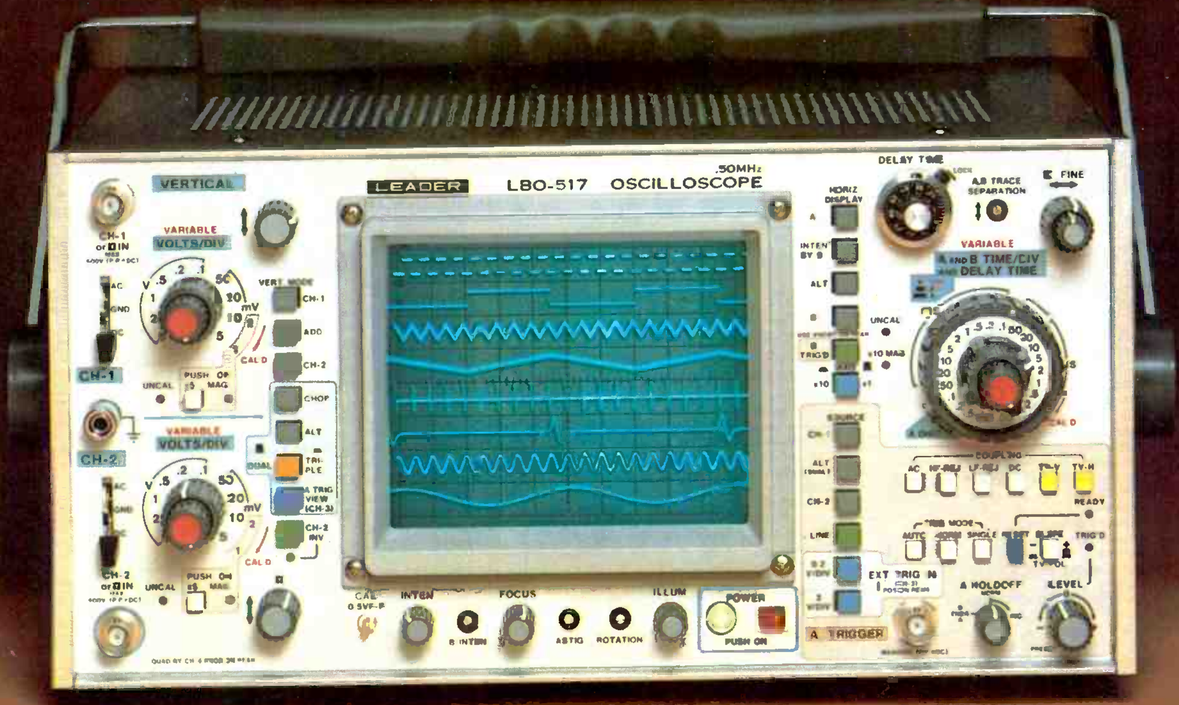
It takes a lot more than 60-MHz to beat the 50-MHz Leader.



Mfg. Suggested List Price

$1695.

Here's Proof!

MANUFACTURER MODEL NO.	LEADER LBO-517	TEKTRONIX 2215
ACCELERATING POTENTIAL	20 kV	10 kV
BANDWIDTH/ SENSITIVITY	50 MHz/5 mV 10 MHz/1 mV	60 MHz/20 mV 50 MHz/2 mV
NO. OF CHANNELS	4 CH	2 CH
MAX. NO. OF TRACES	8	4
TRIGGER VIEW	YES	NO
B-ENDS-A MODE	YES	NO
EXT. TRIGGER OF B SWEEP	YES	NO
VIDEO TRIGGER SEPARATOR	V and H	V ONLY
L.F. TRIGGER REJECT	YES	NO
CH-1 AMPLIFIER OUTPUT	50Ω, 100 mV	NO
GRATICULE ILLUMINATION	YES	NO
"UNCAL" WARNING LAMPS	YES	NO

For Information Circle (7) on Reply Card
For Demonstration Circle (8) on Reply Card

In side-by-side comparisons with the Tektronix 60-MHz oscilloscope, the reasons for selecting the 50-MHz LBO-517 become apparent.

Our 20 kV accelerating potential provides the sharp, bright trace that has always been the hallmark of a high-performance oscilloscope.

All the Important Bells and Whistles.

To be really useful today, an oscilloscope needs more than bandwidth. The LBO-517 gives you: ***Four Channels (8 traces).*** Essential for displaying clock or trigger pulses, or for simultaneously looking at three or four terminals of a logic gate. ***B-Ends-A Mode.*** For an even brighter delayed sweep display. Lacking this feature, some signals would just disappear. ***B-Time Base Triggering.*** For displaying some complex signals. Also eliminates jitter on delayed time base. ***Automatic Video Triggering.*** Separates either vertical *or* horizontal sync pulses for stable video waveform monitoring. ***Vertical Amplifier Output.*** Lets you drive less sensitive instruments with just 1 mV input to the LBO-517. ***Illuminated Graticule.*** Needed when photographing waveforms. All of these capabilities, plus ***"UNCAL" Warning Lamps, Pushbutton Switches,*** and more, put the LBO-517 in a class by itself.

Beware of False Economy.

You get what you pay for. Don't be lured by low price alone. You might keep on paying in the long run, by not having the features you need.

Two-year warranty. Evaluation units.

Our two-year warranty (even on the CRT) is backed by factory service depots on both Coasts. Evaluation units are available to qualified customers. **Call toll-free (800) 645-5104 to request:** an evaluation unit, catalog, the name of your nearest "Select" distributor and more information.

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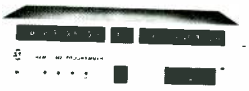


780 SERIES

RAM TIME PROGRAMMERS $1200 to $1500

When programming more than eight events, the **780 Series RAM Time Programmers** are the most cost-effective way of dealing with the problem They are flexible, easy to use, and provide 32 events (expandable to 96) in 5¼ inches of rack space.

780 Series units operate from the power line, with a backup crystal time base and 72 hour battery/charger as an integral part of the equipment

The front panel consists of:

- An eight digit real time display when day selection is required as on the ES 781, 784, 785, seven digits for ES 780, and six digits for the others
- A two digit display of "Next Event" number.
- An eight digit display of "Next Event Time" when ES 780, 781, or 782 is specified, and a six digit display when ES 783, 784, 785, 786 or 787 is specified, and a four digit display when ES 788 or 789 is specified.
- All displays are .3 inch red light emitting diodes
- Controls, mounted below the displays, consisting of·

  An "Active-Disable" Switch used when it is necessary to preempt the program temporarily

  Time Setting Controls—All recessed to avoid accidental bumping

  "Display"—The displays can be observed by actuating this control during a power outage. The unit will continue to operate, but the displays will be blanked to conserve battery energy.

  "Event Select"—A two decade thumbwheel, used to set the event number when entering or reading data in the memory.

  "Event Time Select"—An eight or six or four decade thumbwheel, used to enter the event time in the memory The number of thumbwheels will be determined by the part number of the unit specified

  "Enter"–This pushbutton is actuated to enter data into the memory

  "Run-Read/Enter"—A two position switch, placed in the "Run" position for normal operation, and in the "Read/Enter" position whenever entering data or reading data.

STANDARD UNITS

EIGHT DIGITS OF PROGRAMMING CAPACITY

ES 780—10 Days, 10 Outputs, Hours, Minutes, Seconds
ES 781—100 Days, Hours, Minutes, Seconds
ES 782—16 Outputs, Hours, Minutes, Seconds

SIX DIGITS OF PROGRAMMING CAPABILITY:

ES 783—Hours, Minutes, Seconds
ES 784—100 Days, Hours, Minutes
ES 785—100 Days, Minutes, Seconds
ES 786—16 Outputs, Hours, Minutes
ES 787—16 Outputs, Minutes, Seconds

FOUR DIGITS OF PROGRAMMING CAPABILITY

ES 788—Hours, Minutes
ES 789—Minutes, Seconds

The size of the unit is 5¼" High x 19" Wide x 10" Deep—Relay Rack construction, totally enclosed, with a screen top

ES 782, 786 and 787 have 16 isolated outputs Any of the 32 events can be programmed to activate any of the 16 outputs **ES 780** has 10 outputs The other units have a single output

ES 784, 786 and 788 have a one minute contact closure The others have a one second contact closure Contacts are single pole, form A reed type, and have a one amp rating.

THE 780 SERIES AS A MASTER CLOCK

By adding the **ES 167** Serial Time Code Generator and using a more accurate crystal, the 780 Series Ram Time Programmers can serve the dual functions of Master Clock and 96 event programmable timer.

750 SERIES

THUMBWHEEL PROGRAMMER/ COMPARATORS $310 to $390

When programming up to eight time events, the 750 Series is recommended. Thumbwheel switches are set to compare the time information from an ESE Clock or Timer.

An output (event) occurs each time the thumbwheel switch setting agrees with the time display

One set of thumbwheels is required for each event. The standard 750 Series units are enclosed in a 3½ inch high relay rack panel and chassis.

STANDARD UNITS

ES 750—ES 112 and one 6 Digit Program
ES 751—ES 124 and one 6 Digit Program
ES 753—ES 112 and two 4 Digit Programs (Hrs & Min)
ES 754—ES 124 and two 4 Digit Programs (Hrs & Min)
ES 756—ES 510 and one 4 Digit Program (Min & Sec)
ES 758—ES 510 and two 4 Digit Programs (Min & Sec)

ES 760 $620

ATS CLOCK

The **ES 760** is a six digit, 24 hour, programmable clock.

On the front panel are a six digit display of time, in hours, minutes and seconds, and two sets of four thumbwheels

An internal comparator is fed "Clock Time" and "Thumbwheel Time," and when these two agree, a reed relay contact closure occurs, which is brought to a rear-mounted connector. The connector also provides four line parallel BCD time information

If normal power is interrupted, ES 760 will automatically switch to its internal battery and crystal time base

Mechanical: 3½" High x 19" Wide x 8" Deep.

PRESETTABLE TAPE TIMERS

ES 1296 $195

For Off-Air taping, or operating tape recorders when nobody is there, ESE has created ES 1296

ES 1296 is a six digit, twelve hour clock with LED displays and a programmable, 300 watt, 117V AC outlet on the rear

There are four push-button controls (Fast, Slow, Set and Reset) and a four position selector switch. The Fast and Slow controls are used to set time of day and recorder start time

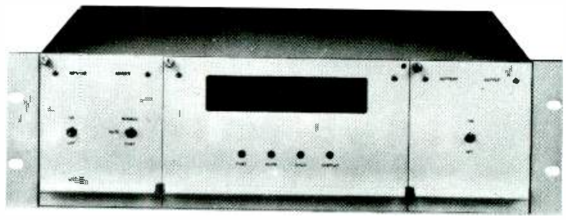
When setting the recorder start time, the Set control is used in addition to the Fast and Slow controls, to set the time to the nearest minute A rear-mounted four position switch is used to pre-set the start time as far ahead as 96 hours

Once the rear outlet is activated, it will remain on for 66 minutes

The **Record Duration** option allows the user to select one of four time intervals for recording These four time intervals are either 16, 33, 66 and 138 minutes, or 33, 66, 138 and 250 minutes

An additional option is **Sequential Turn-on,** for those machines that require Power, Play, Record in sequence

A **Manual Override Switch** can be provided as an option, so that the user may operate his machine at any time without disconnecting from the ES 1296



ESE Masters provide a means of keeping all time displays in the system in agreement, through the use of a Serial Time Code. Only one pair of wires is needed to distribute the time code to all remote serial input displays.

An ESE Master Clock System can operate digital displays, clocks with sweep second hands, printers and, in addition, tell your computer what time it is.

Twelve hours of standby battery operation is standard in ES 160, 160/1 and 190.

MASTER CLOCKS

ES 160 Mounted in a 5¼" relay rack panel and chassis, displays six digits of time information on 3" LED displays, in 12 hour format.

ES 160 has three second per month accuracy. Its standard output is serial BCD, CMOS compatible, and can drive ES 161, 166, 171, 991 or 993 Remote Displays without buffering. All inputs and outputs are through rear-mounted connectors.

Dimensions: 5¼" High x 19" Wide x 15" Deep **$1050**

ES 160/1 One second per month version of ES 160. **$1225**

ES 190 The ultimate in accuracy! Similar to ES 160, with special circuits for receiving and decoding a 1000 Hz tone at the start of each minute. The decoder output resets the seconds' counters in the clock each minute except the first minute of every hour. These tones are transmitted by radio Station WWV, with an oscillator accuracy of ±1 part in 10^{11}. ES 190 has an antenna and internal WWV receiver with audio-output. Displays are .3" red LED's. Serial output drives ES 161, 166, 171, 991 and 993 Remote Displays.

Dimensions: 5¼" High x 19" Wide x 15" Deep. **$1225**

ES 192/194 The most economical Masters. ES 192 (12 Hr) and ES 194 (24 Hr) are constructed using ES 112 or ES 124 digital clocks and adding the ES 167 Serial Time Code Generator to provide the output needed to drive Remote Serial Displays ES 161, 166, 171, 991 and 993. Displays are 6" incandescent type.

Dimensions: 2½" High x 8" Wide x 6" Deep. **$325**

ES 196 TIME AND TEMPERATURE MASTER Basically the same as ES 192, but with gas discharge displays, panel mounting and separate serial BCD outputs for time and temperature. Displays 12 hour and °F format.

Dimensions: 3½' High x 19" Wide x 8" Deep. **$766**

ACCESSORIES

ES 161 REMOTE DIGITAL DISPLAY Decodes serial time data and displays six digits of time on 55" Gas Discharge Displays, in either 12 or 24 hour format.

Dimensions: 8" Wide x 2½" High x 6" Deep. **$165**

ES 162 IMPULSE DRIVER Plugs into the ES 160 chassis, can drive 20 Impulse Clocks. Designed so that, if power fails, impulse always comes on with the same polarity when power is restored. **$200**

ES 164 REMOTE DIGITAL IMPULSE DISPLAY Similar to the ES 161 except that the ES 164 derives its count command from the ES 162 Impulse Driver, or any impulse clock drive circuits already installed

Dimensions: 8" Wide x 2½" High x 6" Deep. **$244**

ES 166 JUMBO 1" CLOCK DISPLAY Features six digits of one inch gas discharge displays in 12 or 24 hour format. Receives serial time code input from any ESE Master Clock or ES 167.

Dimensions: 10½" Wide x 4½" High x 6½" Deep. **$254**

ES 167 SERIAL TIME CODE GENERATOR An integral part of ES 160, 190, 192/194 and 196 Master Clocks, this unit can be added to many other ESE products, including ES 112, 124, 182, 184, 992, 994, 750, 751, 753, 754 and all 780 Series Time Programmers. Drives ES 161, 166, 171, 991 or 993 Remote Displays. **$146**

ES 169 TEMPERATURE SLAVE Receives serial code from ES 196, displays it on .55" Gas Discharge Displays.

Dimensions: 8" Wide x 2½" High x 6" Deep. **$146**

ES 171 CONSOLE MOUNT REMOTE DISPLAY Receives the serial time code generated by any ESE Master Clock, or any ESE product containing the ES 167 serial time code generator, and displays it on bright red 3" LED's.

Dimensions: 2¼" High x 4½" Wide x 4" Deep. **$158**

ES 1546 CONSOLE MOUNT TEMPERATURE DISPLAY In the same case as ES 171, receives the serial code from ES 196 and displays it on bright red .3" LED's

Dimensions: 2¼" High x 4½" Wide x 4" Deep. **$158**

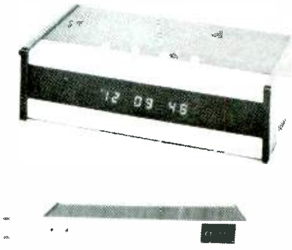
IMPULSE CLOCK When a sweep second hand is desired, specify the 3201.003 "Extra Flat" Impulse Clock. It has a 12 inch dial protected by a glass cover and metal bezel and is approximately one inch thick As many as twenty impulse clocks can be driven by a Master Clock which has ES 162 as an accessory. **$195**

ES 991 4 DIGIT SERIAL INPUT SLAVE Decodes serial time data and displays four digits of time on large 2" gas discharge displays

Dimensions: 10½" Wide x 4½" High x 6½" Deep. Desk Top Case. **$325**

ES 993 6 DIGIT SERIAL INPUT SLAVE Features four digits of 2" high gas discharge displays, and two digits (Seconds) of 1" gas discharge displays. Receives serial time code input from any ESE Master Clock or ES 167.

Dimensions: 5" High x 12" Wide x 3" Deep (Wall Mount) **$449**



SMPTE TIME CODE GENERATOR: ES 261 is a pre-settable, eight-digit SMPTE/Time Code Generator, capable of Drop Frame or Non-Drop Frame operation. **$750**

ES 253 SMPTE TIME CODE READER: is an eight-digit SMPTE Time Code Reader displaying Hours, Minutes, Seconds and Frames. **$454**

ES 254 SMPTE TIME CODE READER: is a bi-directional, multi-speed eight-digit reader, displaying Hours, Minutes, Seconds and Frames on .4" red LED displays. **$675**

ES 255 is a bi-directional, multi-speed, eight-digit SMPTE Code Reader, that can add the information to a video stream for recording time code on the video portion of a tape, or for displaying it on a monitor. Reading speed is 1/20 to 20 times playback speed. **$995**

ES 112/124

DIGITAL CLOCK $165

ES 112 (12 hr.) and **ES 124** (24 hr) are solid state, six digit clocks. Can drive 80 Series and 90 Series slaves Displays are incandescent filament, .6" high
Dimensions: 2½' High x 8" Wide x 6" Deep

ES 142/144

DIGITAL CLOCK THERMOMETER $300

ES 142 (12 hr.) and **ES 144** (24 hr.) are solid state digital clock/thermometers. Six digits of time (hours, minutes, seconds) and 3 digits of temperature (−50°F to +150°F or −45°C to +66°C) in gas discharge displays .55" high. Temperature sensor on 25 ft. cable included.
Dimensions: 2½" High x 10" Wide x 6" Deep.

ES 240/241

ES 240 DIGITAL THERMOMETER is calibrated for °F and °C. Displays are planar gas discharge, .55" high. **$195**
Dimensions: 2½" High x 8" Wide x 6"-Deep

ES 241 DIGITAL THERMOMETER is calibrated for °F and °C, alternating between the two every four seconds. Displays are planar gas discharge, .55' high. **$236**

70 SERIES

CONSOLE MOUNT CLOCKS AND TIMERS

ES 172 SIX DIGIT, 12 HOUR CLOCK: Three setting controls—Fast Advance, Slow Advance and Hold **$158**

ES 174 SIX DIGIT, 24 HOUR CLOCK· Otherwise identical to the ES 172 **$158**

ES 370 FOUR DIGIT, ONE HUNDRED MINUTE UP/DOWN TIMER: Six controls—Count Up, Count Down, Stop, Minutes Advance, Seconds Advance, Reset **$201**

ES 371 UP/DOWN TIMER: Similar to the ES 370 except with Leverwheel Preset capability for faster setting of the desired time **$319**

ES 570 FOUR DIGIT, SIXTY OR 100 MINUTE TIMER: Select 60 or 100 minute mode on rear connector Start, Stop and Reset controls. Runs continuously unless stopped Reset will return all displays to zero. Unit will run if reset while running or will stay at zero if reset when stopped **$158**

ES 572 SIX DIGIT, 12 HOUR CLOCK OR TIMER: Five controls—Start, Stop, Reset, Fast Advance, Slow Advance. Will run continuously to 12·59·59 Advances to 1·00:00 and continues as clock unless stopped or advanced **$192**

ES 574: A 24 hour version of ES 572 **$192**

ES 575: Exactly like ES 570, with the addition of a "freeze" button. When the button is released, the display "catches up' with the correct elapsed time. **$192**
Dimensions: 2 16" High x 4 5' Wide x 4.13" Deep

80 SERIES

JUMBO CLOCKS AND TIMERS

Large, bright 1" gas discharge displays provide effortless long distance viewing from 40 feet

ES 182 SIX DIGIT, 12 HOUR CLOCK: Three rear-mounted setting controls—Fast Advance, Slow Advance, and Hold **$272**

ES 184 SIX DIGIT, 24 HOUR CLOCK: Otherwise identical to the ES 182 **$272**

ES 380 FOUR DIGIT, 100 MINUTE UP/DOWN TIMER: Displays minutes and seconds. with rear-mounted connector to allow remote wiring of six momentary SPST CONTROLS—Count Up, Count Down, Stop, Minutes Advance, Seconds Advance and Reset Other features similar to ES 301. **$316**

ES 381 UP/DOWN TIMER: Similar to ES 380, except that leverwheel preset is used **$416**

ES 580 FOUR DIGIT, 60 MINUTE TIMER: Displays minutes and seconds. Rear connector allows remote wiring of three momentary SPST controls— Start, Stop and Reset. Reset returns all displays to zero, and timer will continue to run from zero if reset while running

80 Series slaves are also compatible with other ESE clocks and timers ES 112/124, 301, 302 and 510 **$228**
Dimensions: 4 45" High x 10.38" Wide x 6 58" Deep

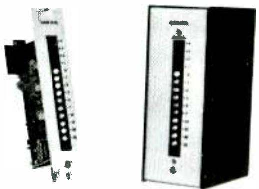
90 SERIES

2 INCH DISPLAYS— VIEWABLE AT 60 FEET

ES 391—Presettable Up/Down Timer: 100 Minute Range—Displays Minutes and Seconds, uses Leverwheel Preset Controls are Count Up Count Down, Stop, Reset and Preset **$487**
Dimensions: 4 45' High x 10 38' Wide x 6 58' Deep

ES 590—Sixty Minute Timer: Displays Minutes and Seconds Rear-mounted connector provides for wiring to user's single pole, momentary, push-button controls Start, Stop and Reset Reset returns all displays to zero, and timer will continue to run from zero if reset while counting. **$228**
Dimensions: 4 45" High x 10.38" Wide x 6.58" Deep

ES 992/994—6 Digit Clocks: ES 992 (12 Hr) and ES 994 (24 Hr)—Hours and Minutes on Two Inch Gas Discharge Displays. Seconds on One Inch Gas Discharge Displays. Three top-mounted setting controls—Fast Advance, Slow Advance and Hold **$449**
Dimensions: 5' High x 12" Wide x 3½" Deep.



$113 **$135**

ES 211/214

DYNAMIC AUDIO LEVEL INDICATOR

The **ES 214** is a highly accurate audio level indicator which is designed to simulate the action of a conventional VU-Meter but with superior dynamic characteristics. The LED meter is five to one hundred times faster in responding to complex waveforms than the mechanical meter without sacrificing the familiar meter "movement"

SPECIFICATIONS

Number of Indicators: 14 LED Lamps in 3 colors
Scale: +4, +3, +2, +1 dB—Red
0 dB—Yellow
−1, −2, −3, −5, −7, −10, −15, −20, −25 dB—Green
Input Impedance: 2200 ohms at maximum sensitivity, 6800 ohms at +8dBm "House Level", 10,000 ohms at minimum sensitivity
Input Circuit: Transformer isolated, balanced bridging
Frequency Response: 20-20 KHz ± 1 dB (all modes)
Rise Times: Less than 250 MicroSec (Peak Mode), less than 25 MilliSec (Fast Averaging Mode), Approximately 300 MilliSec (Optional VU Standard)
Fall Time: (All Modes) About 300 MicroSec from full scale
Modes of Operation: Peak Reading, Fast Averaging (Apparent Loudness), Slow Averaging (USA VU-Standard)

ES 562/564

SIX DIGIT CLOCK/ TIMER WITH MEMORY $313

ES 562/564 is a combination six digit clock and 24 hour timer with memory, allowing the user to set the clock to the correct time of day, switch to timer mode, then switch back to time of day by pushing one button, time of day will be correctly displayed, in hours, minutes and seconds Five pushbutton controls are mounted on the top of the unit, near the front of the desk-top case When panel mounting is specified, they will be mounted on the front panel, below the display The controls may also be remoted, through two rear-mounted five pin connectors (Option R or Option D) These controls are Clock, Fast/Start, Slow/Stop, Timer and Hold
Display: Six digits of 55' Planar Gas Discharge Display

ES 280

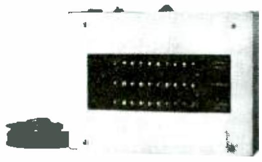
AUDIO TIME CODE GENERATOR/READER

The ES 280 is a 10 Digit Audio Time Code Generator/Reader, capable of laying down a serial BCD time code on audio tape in the Generator Mode, and recovering and displaying it in Digital form in the Reader Mode The code has been designed by ESE It is not a standard code, such as SMPTE or IRIG The frequencies used to produce the code have been selected to be compatible with cartridge machines as well as other tape recording and playback equipment. Amplitude adjustment assures the right amount of signal for the particular machine being used.

ES 510L

FOUR DIGIT 60 MINUTE TIMER $158

ES 510 is a four digit, sixty minute timer (59:59) with Start, Stop and Reset controls. If stopped, display will hold time reading and when restarted will continue with next count from last displayed figure. If reset while running, timer will continue to run. ES 510 can drive 80 Series and 90 Series Slaves
Dimensions: 2½" High x 6" Wide x 6" Deep.



ES 203/205 $ 89

ES 203/205 is a 20 input Timer/Source Interface. It was designed to provide a simple means of connecting a variety of sources such as carts and turntables to the remote input of ESE Timers The most common application for this product is resetting either an ES 400 or ES 510 Timer each time a source is started

The 20 inputs are divided into ten DC voltage inputs and ten contact closure inputs Activation of any one of these inputs will cause an output which will momentarily reset an ESE timer
Mechanical: Aluminum Case 8" x 6" x 2".

ES 301/302

100 MINUTE UP/DOWN TIMERS $234 $302

ES 301 is a four digit, one hundred minute timer (99 59) with six controls. Count Up, Count Down, Stop, Minutes Advance, Seconds Advance, Reset Counting can be activated up or down or set back to zero. When "Stop' control is pressed, the four digit display is held. Counting direction (up or down) can be changed or time can be reset to zero without stopping the count The ES 301 can drive 80 Series and 90 Series Slaves Displays are gas discharge, 55" high

With the **ES 302,** the user can preset times much faster than with the ES 301, because lever-wheel type switches are used for the preset feature The ES 302 can drive 80 Series and 90 Series Slaves
Dimensions: ES 301 2½" High x 8" Wide x 6' Deep
ES 302. 2½" High x 10" Wide x 6" Deep.

ES 206

VIDEO TIME AND DATE GENERATOR $475

The **ES 206** has been designed to allow the addition of Time and Date information to a video signal Two rear-mounted video jacks permit "looping" the video information through the 206 to add the data.

ES 270 IRIG B TIME CODE READER $350

The **ES 270** TIME CODE READER has been designed to be an ecomomical solution to the problem of receiving and displaying IRIG B.

Nine digits (Days, Hrs, Min, Sec) of time are shown on bright red LED's, .3" character height.
ES 270 comes in a rack mounting enclosure, 1¾"High, 19' Wide and 10" Deep
The power requirement is 117V AC, 50/60 Hz, 230V AC, 50 Hz is available as an option

ESE

142 Sierra Street El Segundo, CA 90245
(213) 322-2136

Circle (9) on Reply Card

editorial

Specs: Distorting the facts

Broadcasters, as consumers, are protected by law against false claims and misrepresentations in advertising and promotional material. The regulations regarding truth in advertising may raise the price of our goods, but the improvement in customers' confidence resulting from the laws is worth the cost.

We take no issue with rigid laws and their strong enforcement concerning truth in advertising and sales literature. What we *do* take issue with is the laxness and vagueness in the language used in manufacturers' literature that make it virtually impossible to pinpoint what manufacturers are saying to broadcasters about their equipment.

You've all seen the terms: *broadcast quality*, *state-of-the-art* and *professional*, to name a few. Just what do they mean? *Broadcast quality* should imply a quality of excellence that meets a broadcaster's needs when the equipment is placed in a typical broadcast chain. However, the term is not specific, and the quality claimed in the specs may fall below the minimum requirements for sound and picture demanded by exacting broadcasters.

The much abused term *state-of-the-art* is even more nebulous. It's like morals—subject to time and place. The electronics technology is changing so rapidly that nearly everything is outdated by the time the circuits are designed and produced. Even more crucial, every product is subject to design and marketing constraints. There can be sound business reasons for a manufacturer *not* to use the latest devices and circuits for a specific product. Price, delivery and reliability are just a few of these reasons—and no manufacturer can be careless in considering these marketing factors. So if you acknowledge these facts of life, *state-of-the-art* has little meaning.

Professional tends to be a term flattering to our industry, but it is not specific for engineering purposes. Although it may serve as a buzzword to gain attention, it does little to convey the performance data required by engineers who are concerned about signal quality and who demand high reliability under stringent operating conditions.

But the confusion does not end with the non-specific nature of our technical language. To this can be added the wide range of practices followed in reporting equipment performance and specifications. Some companies report only peak performances obtained in the labs under idealized conditions. Others, remaining conservative, list typical specs that should be obtained under normal operation in a broadcast station with well-maintained equipment. Most companies probably fall between these two extremes, but we applaud those that lean toward the conservative end of the spectrum.

Thus, the engineer is faced with confusion in language and questionably reported specs when he slogs through ads, sales literature and equipment manuals. So, what is the solution? How can the confusing cobwebs created by buzzwords and practices be cleared away to reveal the truth in equipment performances?

Frankly, in practical terms, it probably cannot be done. Unless the standards-setting organizations—such as SMPTE, EIA, IEEE and AES (to name a few)—come to grips with the problem, set forth codes for reporting specs and define standard terms that are relevant and specific, the current practices will continue.

In the end, it will probably remain the role of the engineer to penetrate the communications barriers and get to the bottom line. The engineer will have to ascertain if the equipment meets his station's needs in terms of performance and reliability, especially in his broadcast chain. And this has to be done at a price that is reasonable for his operation.

On a practical level, engineers rely heavily on industry communications, local SBE activities, trade shows, personal communications with other engineers, local sales reps, and their own evaluations, for information vital to their purchases. All else being equal, the company with the best local service will probably get the order.

However, even though the engineer will probably continue to resolve the specs issue, we still urge that standards organizations stress exactness in the language and that manufacturers adhere to clearly described methods in reporting data. And, to those companies that adhere to the commendable practice of conservative ratings, we urge that they state this fact in their data.

Communication is not unilateral. Each month **Broadcast Engineering** strives to bring you the information you want and need. As we assemble an issue, we draw on widely varying backgrounds in the journalism and broadcast spheres. Objectivity is a key to our work, but we do have opinions, and so do you. This editorial page is our soapbox to air opinions on current issues, such as the use of unclear language and questionable specifications in manufacturers' literature.

But the communication loop will not be complete without your participation. Give us your comments on our opinions, as well as your thoughts on other topics. Our *Feedback* column will include some of your responses. Through this interaction we will better serve you, perhaps even solve a problem or two with the discussions. Opinions that differ from our own are welcome, and so are confirmations on key issues.

Address comments to: The Editor, **Broadcast Engineering**, P.O. Box 12901, Overland Park, KS 66212.

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FCC update

September 1982

Harry C. Martin, partner
Midlen, Reddy, Begley & Martin

Comparative renewal standard affirmed

In July, the US Court of Appeals for the District of Columbia Circuit affirmed the commission's grant of the renewal application for station WESH-TV 2, Daytona Beach, FL, and denied a competing application. The court approved the commission's concept of renewal expectancy based upon "substantial" service by the encumbent licensee. The decision means that the usual comparative factors of diversification of control and integration of ownership and management will not be controlling, when a renewal applicant can demonstrate it has provided substantial service to the public during the license term under consideration. Under the commission's standard, the degree of renewal expectancy accorded to an incumbent licensee will be determined by the level of service the station has provided.

Network ownership of cable systems considered

The commission has adopted a Notice of Proposed Rulemaking seeking public comment on whether its multiple ownership rules should be changed to permit the major networks to own cable TV systems. The proposed changes signal the beginning of overall evaluation by the Fowler commission of the present rules limiting multiple and cross-ownership of media interests. Within the next year or two, the commission is expected to re-examine its cable/broadcast, one-to-a-market and 7-station rules as well.

Dual-city station ID changes proposed

The commission has proposed to permit stations that provide city grade coverage to communities other than their cities of license to name those communities in their station IDs without first obtaining FCC approval. Dual-city station identification would be permitted upon certification to the FCC that the required signal strength to the second community was being provided.

The proposed rule change is significant because signal strength has never been more than a threshold criterion for a showing to support a request for dual-city identification. Thus, if the proposed rule is adopted, no showings would be necessary with respect to the station's economic need for dual-city identification or the ties between the community of license and the second community. To begin to identify with another community, a certification of one of the following signal strengths would have to be provided to the FCC:

- TV—74-80dBu (depending on channel number) over the entire city;
- FM—3.16mV/m over the entire city; and
- AM—25mV/m over the business or factory areas and 5mV/m over the most distant residential section.

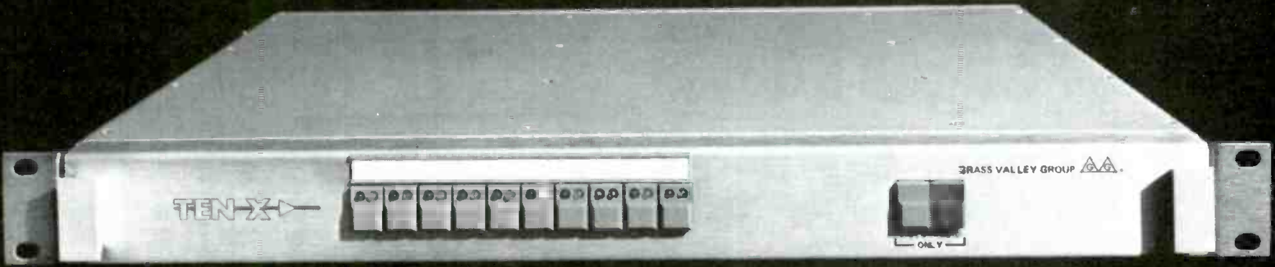
UHF comparability policy presented

The commission has issued a policy statement and several rulemaking decisions on the issue of UHF/VHF comparability. The commission found that UHF has become increasingly viable and profitable and is capable of substantial future growth. It said that the percentage of UHF stations reporting profits has risen consistently since the early 1970s. In 1980, 58% of UHF TV stations reported profits as compared to 59% of AMs, 55% of FMs, and 81% of VHF stations.

The commission took the following related actions:

- instructed its staff to draft a notice of proposed rulemaking that would reimpose a limit of 12dB on UHF noise figures (the current limit is 14dB);
- dropped proposals requiring manufacturers to install integrated channel selectors that use the same control for selecting VHF and UHF channels;
- declined to require greater channel capacity for push-button or single-dial *menu* types of channel selectors, or require pretuning and labeling for UHF channels on push-button types,

VERSATILITY



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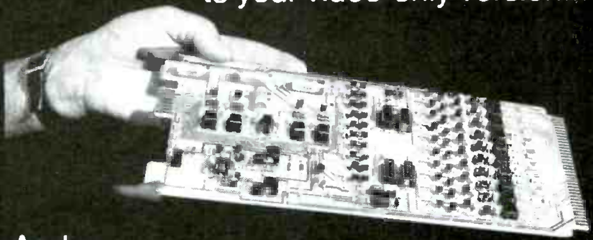

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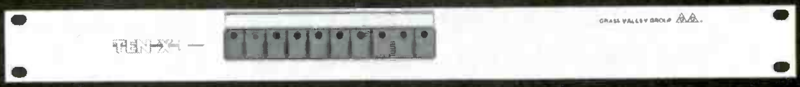

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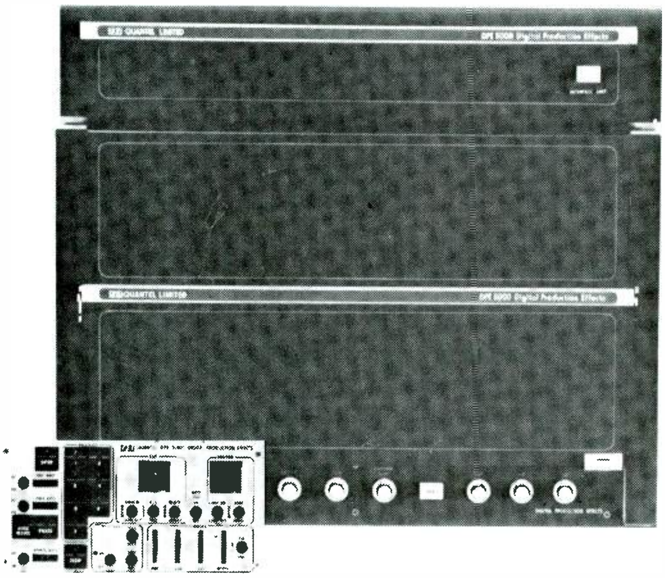
For Rent: Quantel DPE 5000.



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and eliminated other rule provisions concerning UHF selectors;

- eliminated the requirement that TV sets be capable of receiving Channels 70 through 83, because those channels have been reallocated to the land mobile radio service;
- dropped proposals that would have required equality between reception aids provided for VHF and UHF;
- decided to provide funding for an information program in the FCC's Office of Public Affairs to provide for the dissemination of consumer information about UHF reception; and
- dropped a proposal to require manufacturers to grade or label TV receivers or antenna systems.

Paid announcements to air on non-commercial stations

The FCC has announced it will permit non-commercial educational broadcasters to air paid promotional announcements for *non-profit* groups as long as the announcements do not interrupt regular programming. Non-commercial stations, however, still may not accept payment for announcements on behalf of for-profit entities.

NAB update

This column contains updates, revisions and corrections to our June NAB-'82 coverage. Use the reader service numbers for more product information.

THOMSON-CSF COMPONENTS
TH347 tetrode

The TH347 coaxial design tetrode is suggested for linear amplifiers operating up to 1GHz (not 10Hz as stated in our June issue). With applications requiring common video and sound carrier translators, the TH347 anode dissipation is rated at 4.5kW.

Circle (450) on Reply Card

TH382 tetrode

Rated for 5.25kW (not 5.25W as indicated in our June issue) for common video/audio carrier amplification, the TH382 is capable of 11kW for video carrier only applications. Pyrobloc grids, using pyrolytic-graphite materials, give increased stability.

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AWESOME POWER

Let the Ampex AVC switchers unlock the creativity inside you.

Now Ampex gives you a quantum leap in creative video power.

The microprocessor-based AVC Series production switchers offer unequaled multi-level video power. And the simplicity of operation that Ampex provides makes the AVC your video tool for the future. You add only talent.

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Unrestricted keying power comes from the flexible keying system. The AVC's standard key memory remembers up to four separate and distinct key setups for each input. And the panel-oriented STAR™ Memory System increases your capabilities at the simple touch of a button. You can store and recall up to eight complete switcher setups or any desired part of a setup. Plus swap and transfer setups from M/E to M/E.

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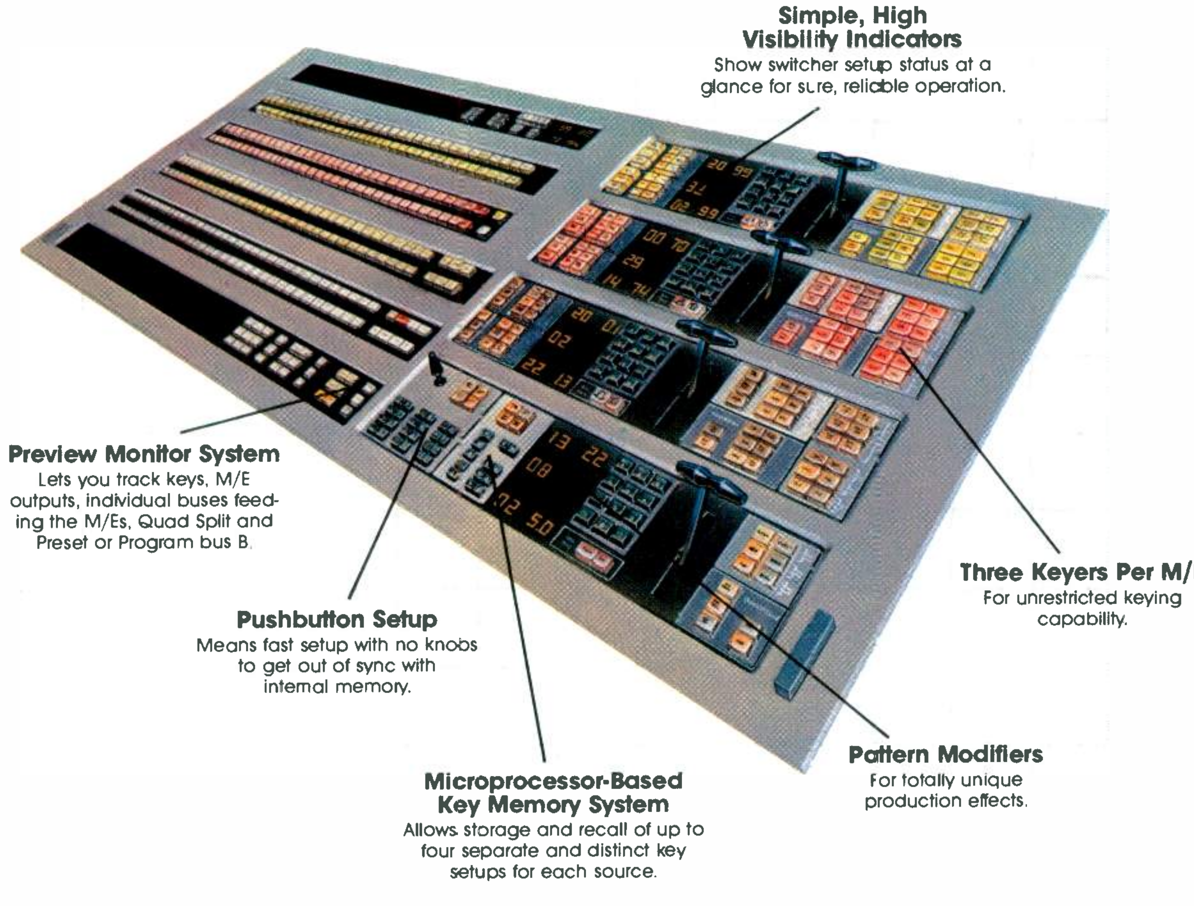

Simple, High Visibility Indicators
Show switcher setup status at a glance for sure, reliable operation.
Preview Monitor System
Lets you track keys, M/E outputs, individual buses feeding the M/Es, Quad Split and Preset or Program bus B.
Three Keyers Per M/E
For unrestricted keying capability.
Pushbutton Setup
Means fast setup with no knobs to get out of sync with internal memory.
Pattern Modifiers
For totally unique production effects.
Microprocessor-Based Key Memory System
Allows storage and recall of up to four separate and distinct key setups for each source.

VRC technology doubts raised

Marketing efforts and design breakthroughs in video camera and recording technologies have not overcome substantial market resistance to the integrated Video Recorder/Camera (VRC)* technology. That resistance was clarified in a videotaped panel discussion, "The Search for Standards," recently distributed to US and Canadian subscribers of the Video Newscasting Network. VNN is a series of management-oriented tapes intended for the private viewing of industry professionals.

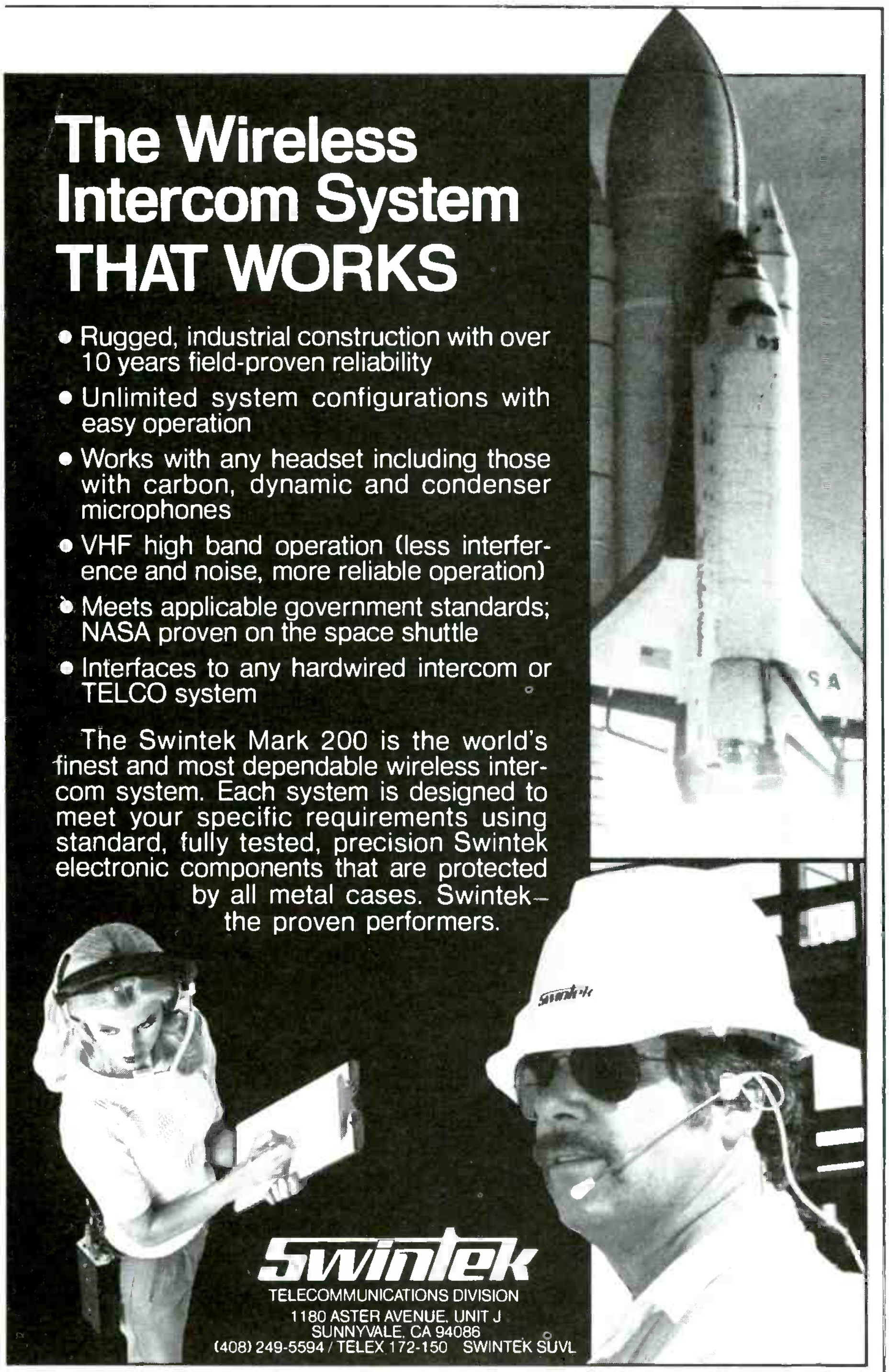
Julius Barnathan, president of engineering, ABC TV Network, challenged fellow panelists representing Sony, RCA and Bosch-Fernseh. He said that capabilities of the new VRC systems do not meet ENG requirements practiced at networks and stations. Barnathan said that the component video recording technique used in the Sony Betacam and RCA Hawkeye systems produced a signal requiring greater bandwidth than could be transmitted by field microwave equipment. As a result, users of VRC systems must physically transport their tapes to the station for airing.

Charles Felder, representing Sony, and Robert Thompson, for RCA, said that an adapter or an NTSC output on the camera could be used to encode the component signals into a compatible NTSC format for use in microwave transmission. Users of adapters would have to pay extra for that piece of equipment, besides the premium already paid for the single-piece VRC system. The purchase cost of the combo VRC systems exceeds that of existing ENG cameras designed with an NTSC output signal ready for microwave transmission.

Since the simultaneous appearance of four VRC systems at NAB-'81, the broadcast community has insisted on a concerted effort toward standardization, assuring users of multiple sources and intersystem compatibility. Although RCA and Sony have proposed sets of standards to the SMPTE, the panel discussion revealed that fundamental hurdles must be overcome before even standardized VRC systems could be viewed as staples for ENG operation.

During the discussion, Dr. Dieter Pohl, representing Bosch-Fernseh, presented the differences between his company's ¼-inch system and the ½-inch equipment from RCA and Sony. The Fernseh KBF-1 system provides size and weight advantages and may not present as severe a problem for microwave transmission. After the explanation, Barnathan, impressed by the approach, suggested that if the system were *deliverable*, he would certainly be a prospective customer.

The panelists concluded that VRC technology may play a significant role in TV production activities for programs, documentaries and commercials, in which the systems' improved video quality could be advantageous. Such teleproduction needs rarely require microwave transmission. Also, the signal quality needs in teleproduction generally exceed those for newsgathering. That higher quality is



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*The emerging video recorder-in-camera technology has moved too rapidly for standards in terminology to have developed. For simplicity, until such terms have been accepted, **BE** has elected to refer to these systems generically as VRCs (video recorder/cameras). The SMPTE reported at NAB-'82 some progress in standardization work for the VRCs.

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now found in 1-inch systems, but they tend to be too expensive and unwieldy to compete with conventional film equipment in single-camera field production applications.

Harris, Kahn AM stereo approved

On Aug. 4, the FCC approved AM stereo transmissions using the Harris approach. WQXI, Atlanta, GA, was expected to sign-on in stereo on Aug. 6. Another 10 stations were expected to be in live stereo by Labor Day, according to Gene Whicker, vice president/general manager of Harris Broadcast Division, Quincy, IL.

Meanwhile, the Kahn AM stereo system was given approval with conditions on July 22. An FCC source explained that the commission requested further data to answer some items in the application which it felt were still unclear. The information was needed by Aug. 12, and if satisfactory would clear the Kahn system unconditionally. If not, the application would return to the pending status.

Questioned about the conditions, Leonard Kahn, Kahn Communications, Garden City, NY, stated that the conditions involved some instruction book materials and proprietary information. He said the data would be in the commission's hands by the due date and that he "felt very good about the progress in AM stereo." He noted that many stations are using Kahn systems in the large markets—including ABC, CBS and NBC affiliates.

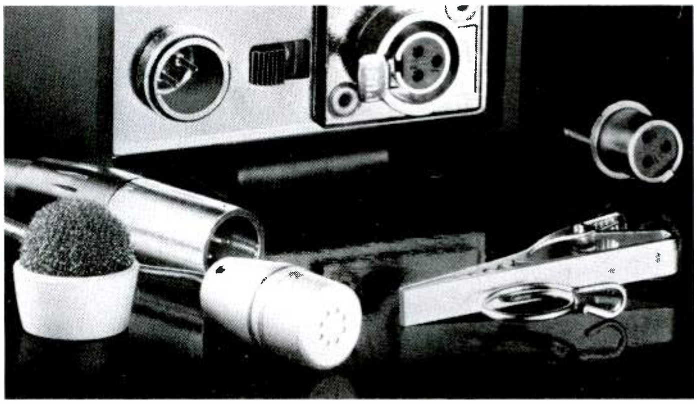
Both Harris and Kahn have been working closely with receiver manufacturers. Whicker indicated that about six systems were reserved for US and Japanese receiver companies to develop home and automotive units. Kahn listed the Mura Corporation as active in developing circuitry for receivers, but he would not divulge names of other organizations also creating circuits for AM stereo. High interest is being shown in adapters for automotive radios as well, Kahn noted.

The implementation of receivers will remain the stumbling block for AM stereo. The binaural imaging is possible with the Kahn plan by the use of two AM receivers. A left channel may be heard by tuning one receiver slightly below the AM carrier; the right, by tuning a second receiver slightly above the carrier. Kahn indicated that surprisingly good sound is reported to him by many who have tried the experimental reception. Many are using two portable radios patched into external inputs of their home stereos.

At an NAB-'82/Dallas press conference, David Hershberger, designer of the Harris system, announced that the Broadcast Division and the Semiconductor Division, Melbourne, FL, were on a crash program to develop a decoder chip. His projection at the time was that devices should be available in three to four months. On Aug. 12, Hershberger updated his projection by saying that it was in the layout stage. Some changes had been requested by Delco Corporation, a major manufacturer of automobile radios, which has expressed interest in producing a receiver using Harris ICs.

The Harris decoder will be produced using silicon planar diffused junction technology. Engineering samples will be available in early November of 1982, with production quantities expected in February 1983.

Think of us as your mike expert.



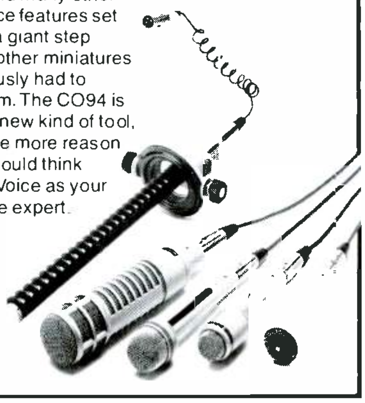
The CO94. All miniatures are not created equal.

Until now, the engineer faced with selecting a miniature microphone was hard pressed to find any dramatic differences in performance. That is, up until the Electro-Voice CO94.

For starters, the CO94 offers unprecedented dynamic range. It has 10 dB greater sensitivity and 20 dB greater input SPL handling capability than the best known competitor. This high performance makes the CO94 ideal for stereo spaced-omni recording, close miking of high output musical instruments, as well as standard lavalier applications.

The CO94 also offers exceptional powering flexibility. It can be powered by a standard 9-volt radio-type battery. Or it can be phantom powered from a mixing board, recorder, or in-line supply. The 9-volt battery can even be used as a redundant power source to "back-up" the phantom power. Plus, the CO94's advanced electronic design permits powering from virtually any DC power supply, capable of delivering between 8 and 50 volts. The internal regulation and filtering will make the CO94's impedance converter swear it's being powered by an over-priced import supply.

These and many other performance features set the CO94 a giant step above the other miniatures you previously had to choose from. The CO94 is a versatile new kind of tool, and just one more reason why you should think of Electro-Voice as your microphone expert.



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RCA favors NABTS teletext standard

RCA recently announced its decision to support the North American Broadcast Teletext Specification (NABTS) standard for a proposed new consumer TV information service. The same standard is also being supported by NBC and CBS.

Dr. William M. Webster, vice president, RCA Laboratories, said RCA believes the NABTS standard offers the industry and the public the best

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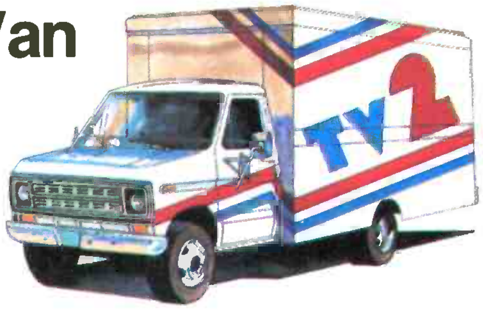

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choice of features and cost advantages. He urged early adoption of the NABTS system as the single US standard for all teletext manufacturers and broadcasters.

Webster cited important benefits from a single teletext standard such as the ability of the consumer to move decoders from location to location, the opportunity to receive all teletext services in an area, and the inherently lower costs of a single system.

Webster said that RCA's support for the NABTS teletext standard was based on the following points:

- The NABTS features high resolution graphics, which are required for such applications as weather maps, news illustrations, games and advertisers' logos and products.
- The NABTS permits efficient transmission of data within the standard TV signal, offering consumers more pages of information.
- The NABTS system has been designed to be upgradable over time, in keeping with advances in technology. Performance upgrades would be done in a compatible manner so that early decoders would not become obsolete.

Smithsonian Galaxy receives gold metal

Smithsonian Galaxy, a series of twice-weekly, 2½-minute radio features from the Smithsonian Institution in Washington, DC, received a gold medal in June at the International Radio Festival of New York. The new radio competition, to be held annually, had more than 750 entries from many countries in its several divisions.

Smithsonian Galaxy won in the general interest category for information programs. A production of the Smithsonian's Office of Telecommunications, *Galaxy* explores the institution's 13 museums, the National Zoo and various research centers.

Executive discusses electronic film-making

HDTV technology will provide easier and less time-consuming production techniques for cinematographers, according to Grant Smith, executive vice president, Sony Technology Center.

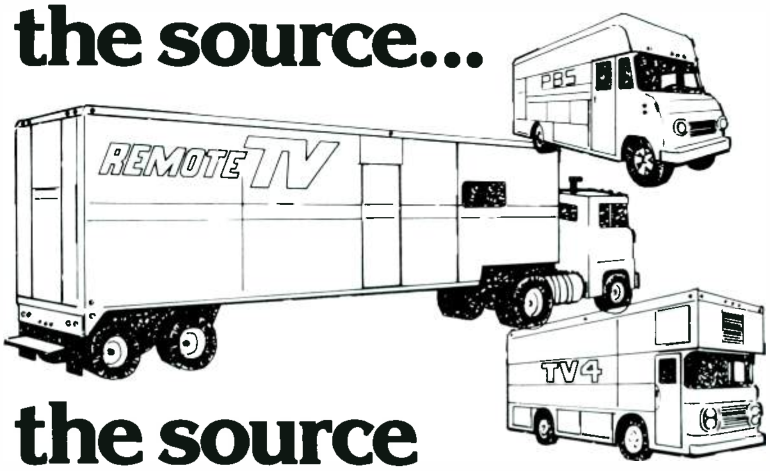
Addressing the American Society of Cinematographers, Smith said that this technological advance is dependent upon scientists and film-makers arriving at a trade-off between video resolution and aspect ratio, as well as the proper quantity and color designations of channels in the video signals.

Video recorders, cameras, monitors and projectors have finite bandwidth. Required bandwidth increases rapidly in direct proportion to aspect ratio if equal horizontal and vertical resolution are to be maintained in HDTV images. As far as signal type is concerned, Smith said that options are being considered using a 2-channel path with one for black-and-white and one for color information, or using four channels with various distributions of black-and-white and color information.

Smith told the group that Sony planners envision a 3-step evolution in the application of HDTV to film-making. "In the first phase, original production would be accomplished on tape," he said. "Post-production could be executed entirely, including special effects, staying with tape until the edited master is complete. This master would then be transferred to film and duplicated for distribution."

In the second phase, Smith said that mini-theaters holding a few hundred viewers could use large-screen video technology so that distribution could remain on videotape. The third phase would come when a full-size, widescreen video projection system is developed. The source of the video signal could be tape or, for better security from piracy, satellite or cable transmission.

When you cover the action from the source...



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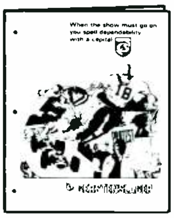

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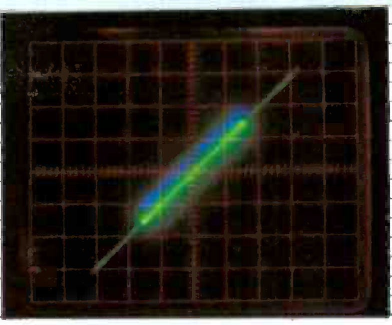

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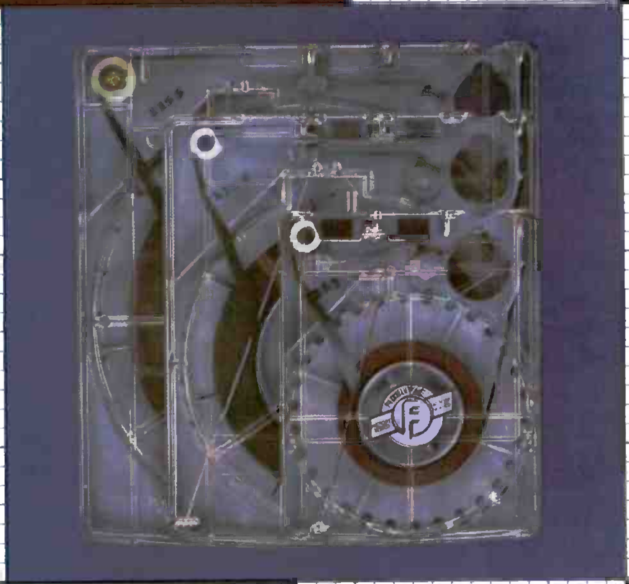

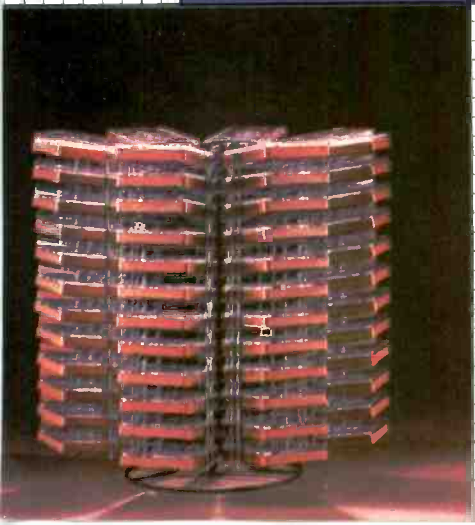

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Junkie with candle and hypodermic needles.
Taped by Jon Alpert.

Western Afghanistan villagers, during Soviet invasion.
Taped by Jon Alpert.

NOW GROWN ARE NO AFRAID OF

For years, newsmen have suffered from the recurrent nightmare of shooting in the dark. They've struggled with low-light situations where artificial lighting was either too intrusive or too difficult to achieve.

But now, thanks to the Sony BVP 330, the cover of darkness no longer stops reporters from covering a story.

The BVP 330 is used consistently in low-light situations by award-winning video journalists and documentary producers like Jon Alpert, Frank Beacham, and Warren Jones. It enables them to shoot under the worst

Sony is a registered trademark of the Sony Corp. © 1982 Sony Corp. of America, 9 W. 57th St., New York, N.Y. 10019.

Suspect in police custody.
Taped by Frank Beacham and Warren Jones.

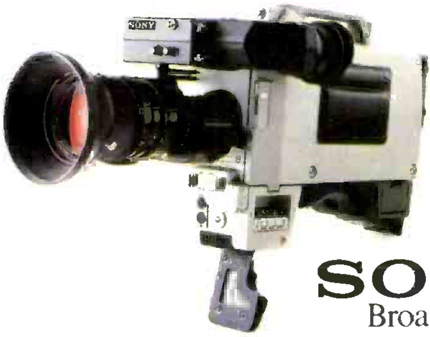
Dade County Police questioning teenagers.
Taped by Frank Beacham and Warren Jones.

NEWSMEN LONGER THE DARK.

conditions, and capture elusive footage like the examples shown here.

The BVP 330 is so versatile in low-light situations, newsmen are surprised to learn that the camera is lightweight and sturdy enough to be taken into the jungles of Nicaragua. Or that its performance is good enough to enable it to be used as a studio camera.

But it makes sense that the BVP 330 should be this good. After all, when a reporter risks his life getting a story, the last thing he should have to worry about is losing it to darkness.



SONY
Broadcast

Located at the Studer headquarters building in Regensdorf are management, manufacturing and engineering operations, as well as most of the Studer final assembly and machine tool processes. This plant is operating at capacity and an identical building is under construction across the street to expand operations and to eliminate temporary facilities that have been set up to cope with the company's growth.

Plant tour: Studer Revox

By Gary A. Breed, chief engineer, WCBU-FM/WTVP-TV, Peoria, IL

Broadcast Engineering recently toured the Studer Revox manufacturing facilities in Switzerland and West Germany. We found that the reputation for quality and precision engineering that the names Studer and Revox have earned is no accident. Throughout the organization, there is an attention to detail and a commitment to quality that should be copied by any company that desires to be the best in its field.

Let's take a pictorial tour of the corporate headquarters and Studer manufacturing facility in Regensdorf, Switzerland, and the plants in Säckingen, Löffingen and Bonndorf, West Germany, which manufacture the Revox product line and most of the Studer component parts.

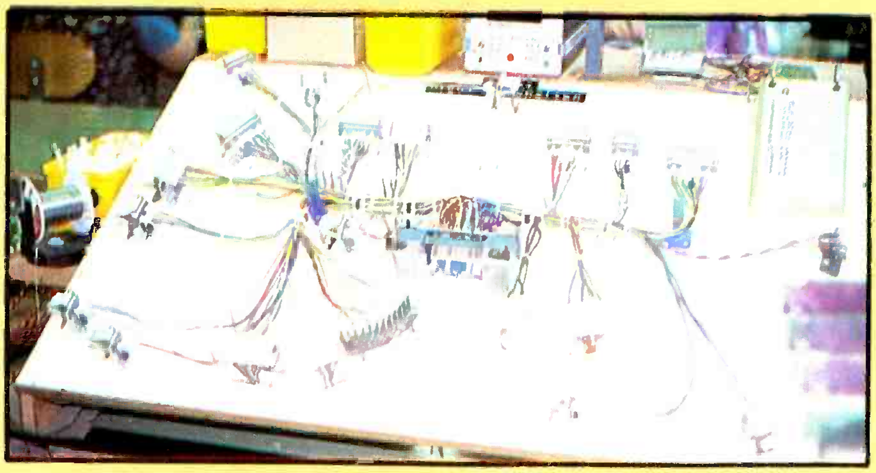
Editor's note:

Last year we began a department of *journalistic plant tours* to let you see some of the staff and facilities of companies manufacturing equipment for broadcasters. We included response numbers and our readers voted for us to continue such coverage.

We were invited by Studer Revox to tour its facilities in Europe and in Nashville, TN. Because of prior commitments, we asked the author to represent us for the European tours. Bill Rhodes, editorial director, and Carl Bentz, technical editor, toured the US facilities while attending the SMPTE Winter TV Conference in February 1982.

This information is provided as a service to BE readers who may or may not be able to take an actual plant tour. We plan to *tour* other facilities as time and space permit. If you would like to see a particular organization included, write and let us know.

In the photography studio of the Studer Revox advertising department, a bookshelf speaker is being photographed. The Studer companies have complete photography, art, graphics and advertising departments, as well as their own modern printing facility. All promotional material, brochures and sales material are done in-house.



At the Säckingen plant, cable harnesses for a Studer tape deck are assembled. Most sheet metal work, anodizing and painting is done at this plant, which is the latest addition to the Studer facilities.

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No matter how rough things get in the field, the Shure SM63 Omnidirectional Dynamic Microphone gives your crew the whole story with a lot less handling noise than any microphone in its class. When Shure's engineers developed the SM63 and SM63L (with longer handle), their objective was to create a high-output, lightweight microphone perfect for the needs of electronic news journalists.

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The output of the SM63 is a full 6 dB higher than comparable hand-held interview microphones.

And there are even more precision-engineered refinements. A highly effective internal humbucking coil rejects strong magnetic fields encountered around lights and other broadcast situations. And when things get really tough, the Shure-developed *VERAFLEX*® grille is virtually impervious to rust, moisture and dents. This system includes a highly effective internal anti-wind and -pop filter; and for more adverse conditions, a dual-density two-layer windscreen also is supplied.

The Shure SM63. The hard-working microphone for the working press.

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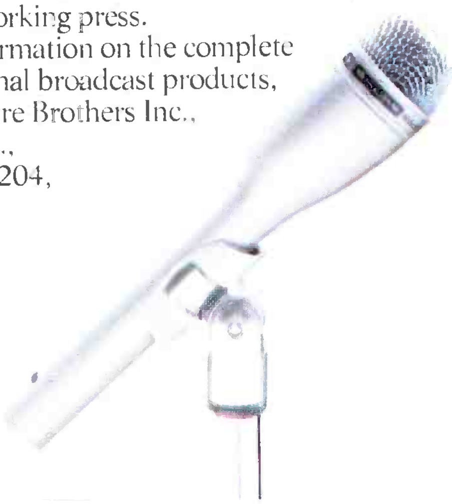
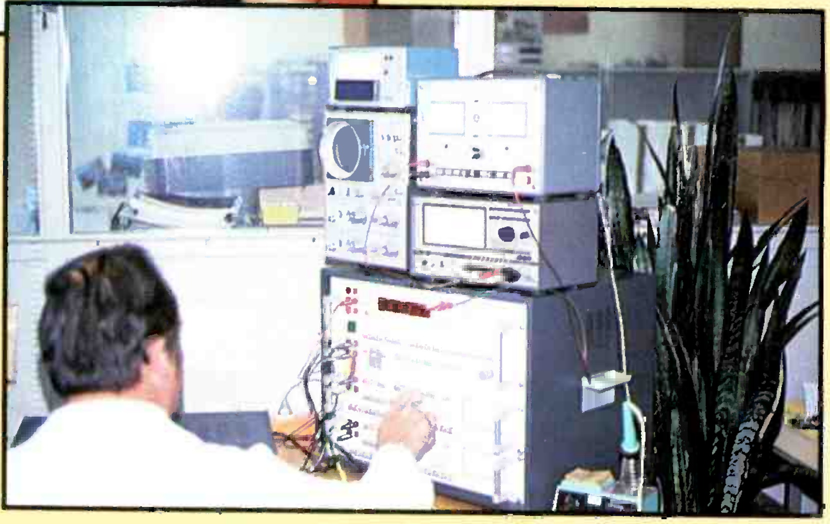


The one finished product made at Säckingen is the Revox consumer turntable. Here, some turntables undergo final checkout before assembly is completed.



This technician is operating one of the many test setups in the manufacturing facilities; this one at Löffingen. Studer builds much of its own custom test equipment, such as the bottom unit in this group. As part of the quality control arrangement, even the test technicians are tested. Samples that have passed through one technician's test station are periodically checked by another technician.

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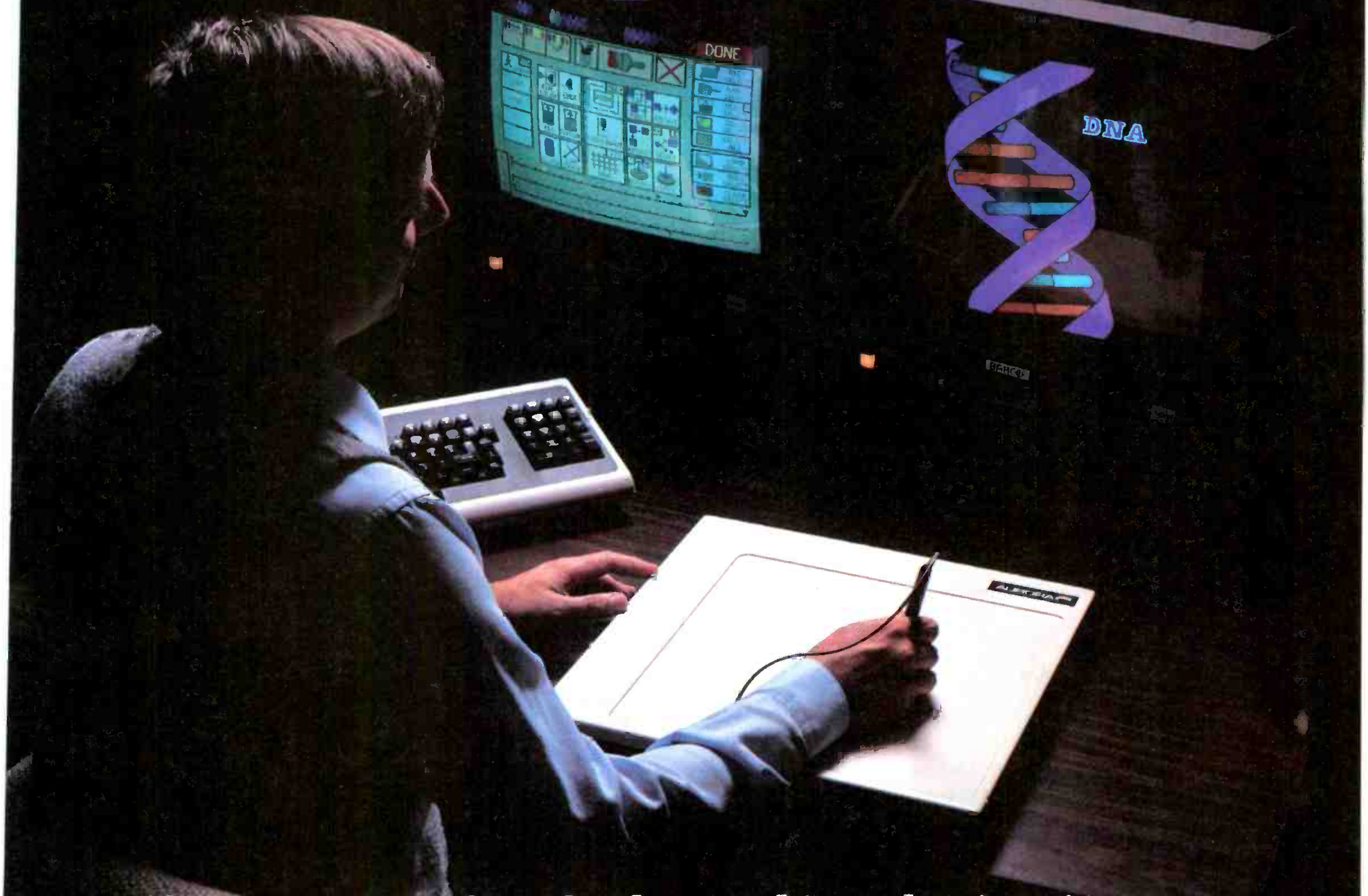
Freedom of Expression



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The Aurora/100 is the most powerful television artist's tool ever developed. We've taken the time to do it right. In fact, our people pioneered in the design and application of digital videographic and animation systems starting in the early 70's.

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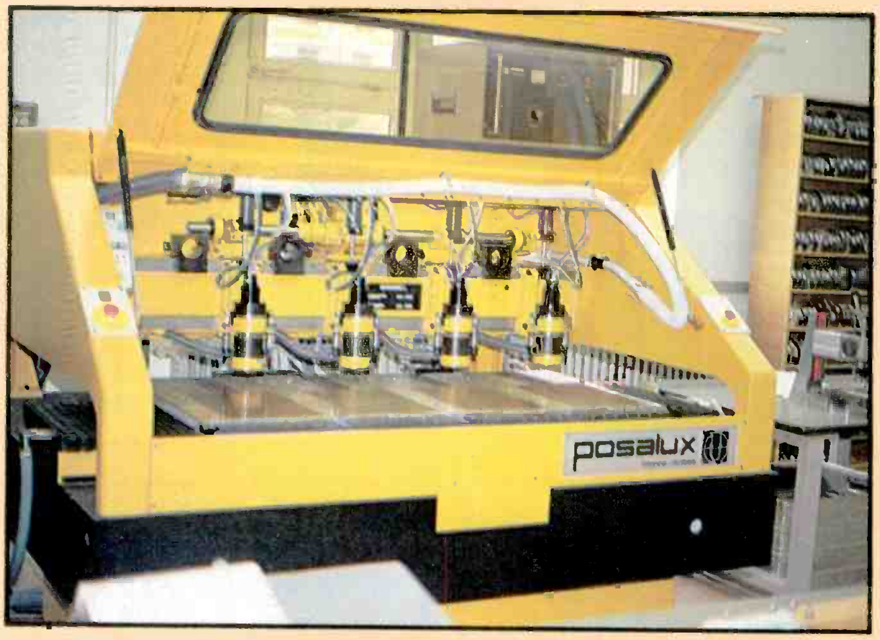
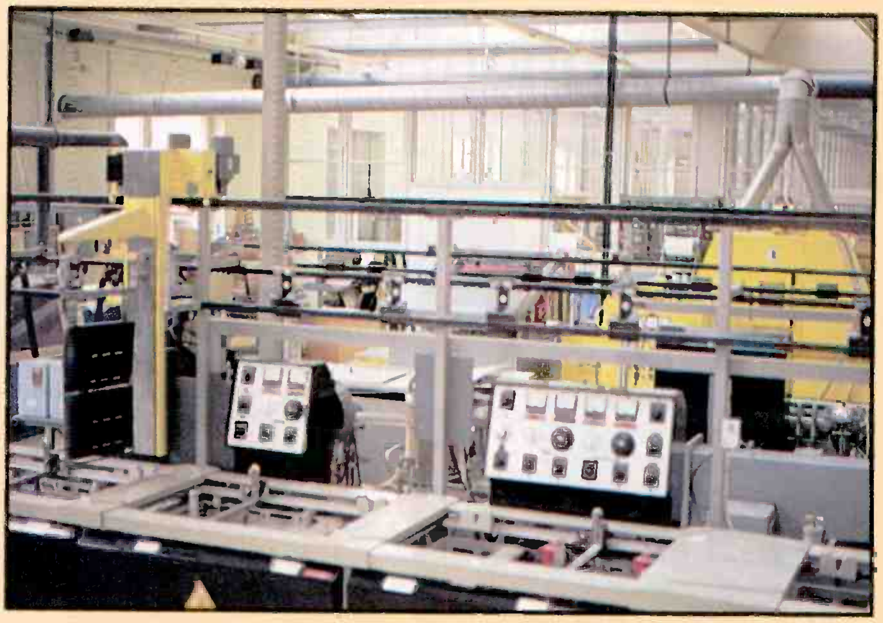
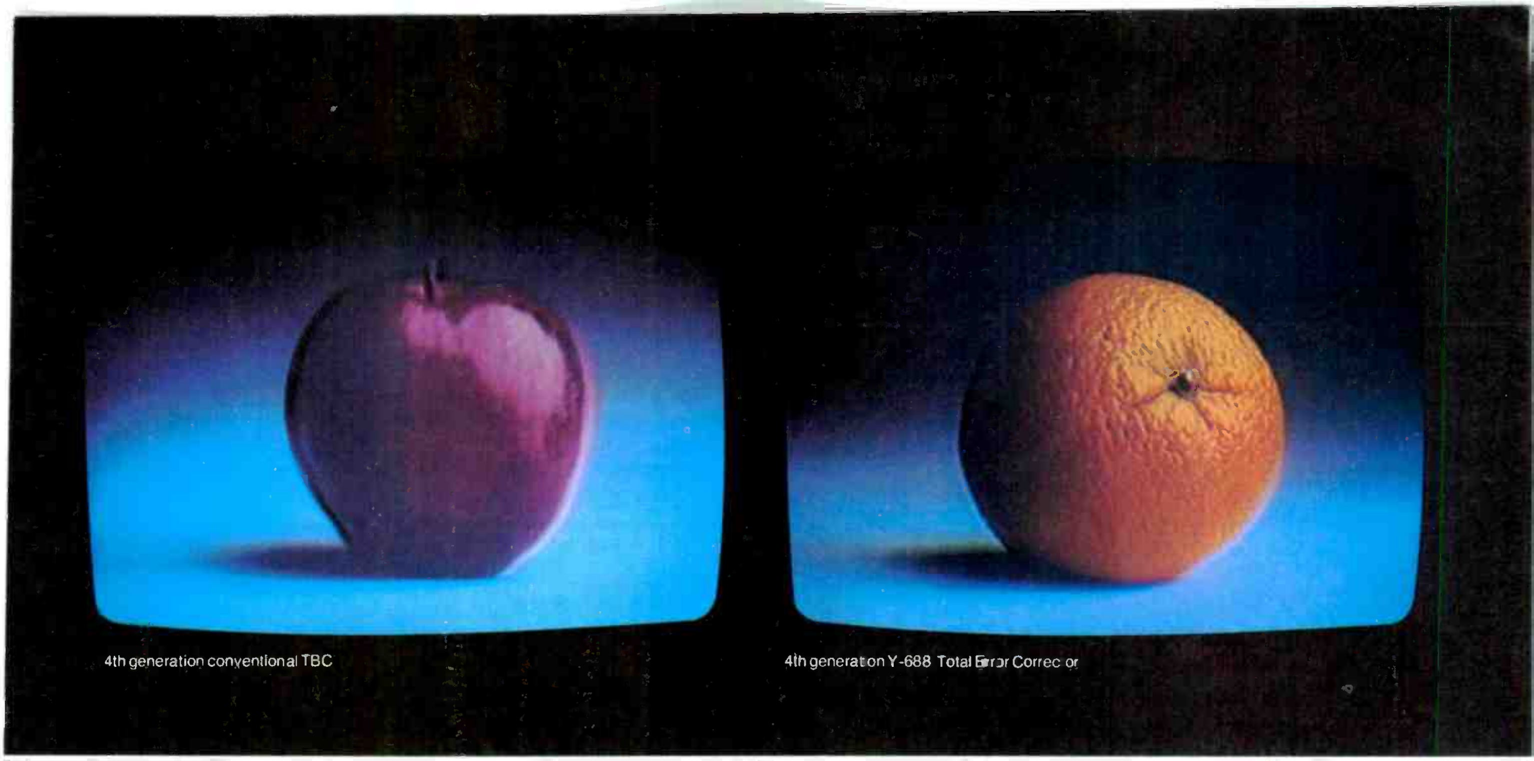
In the Bonndorf plant, automatic insertion equipment is used for much of the printed circuit board assembly, although much is still done by hand. All PC board etching and plating is performed here, as well as most of the wiring.



This automatic, computer-controlled PC board drilling machine drills six holes per second in four boards, and changes its own drill bits. It is an example of the move toward automated manufacturing that was started by the company in the early 1970s.



This is a look across the PC board manufacturing area at Bonndorf. After screening, all etching and plating is done automatically, with numerical control for timing and sequencing each step of the process. At the left of the photo, note the boards being lifted out of the plating tank to be taken to the next processing step. Also note the obvious cleanliness. The attention given to keeping the plants clean and tidy was underscored when our hosts actually apologized for the small amount of clutter and the appearance of the painting facility at Säckingen.



4th generation conventional TBC

4th generation Y-688 Total Error Corrector

NO COMPARISON

Comparing video from a conventional TBC to video from a Y-688^{32} Total Error Corrector is like comparing apples to oranges. A time base corrector, as the name implies, corrects timing errors. The Y-688^{32} Total Error Corrector corrects timing errors and virtually all VTR induced errors.

The major cause of video quality loss in 3/4 VTR's is inherent in the color under process. This process separates the input color video signal into its luma and chroma components, converts the chroma frequency for recording and playback and recombines the luma and chroma for color video output. The worst part is that this quality loss is cumulative, in that it is compounded with each pass through a VTR or conventional TBC.

Total Error Correction

The Y-688^{32} TEC is designed specifically to overcome multiple generation quality loss from color under VTR's. The Y-688^{32} TEC utilizes "dub" (Y-688) input and output as well as encoded video. The "dub" mode allows processing of component (Y-688) video bypassing the separation, frequency conversion and recombination cycle. "Dub" signals processed through the Y-688^{32} TEC are better than encoded video signals because they contain more information and are less degraded.

The Y-688^{32} TEC also utilizes advanced signal processing techniques, some manufactured under exclusive license from Faroudja Laboratories. These techniques reduce chroma noise by up to 20dB, correct luma/chroma timing automatically, reduce luma noise by up to 10dB, improve chroma rise times, reduce second order ringing and eliminate luma/chroma crosstalk. Some processing is used during each pass through the Y-688, while the balance of the processing is used for the last copy or for broadcast to correct any minor degradations which have occurred.

A Difference You Can See

The improved quality of Y-688^{32} TEC video can be seen in first generation playback. It becomes more obvious in successive generations. It is particularly noticeable in third and fourth generations because conventional TBC video has gotten worse with each pass, while fourth generation Y-688^{32} TEC video approximates original quality.

The Y-688^{32} TEC is simply the most powerful tool available for extending multi-generation quality from color under VTR's.

For more information on the Y-688^{32} TEC or an on-site demonstration, circle the reader's card. For immediate response write or call Fortel today.

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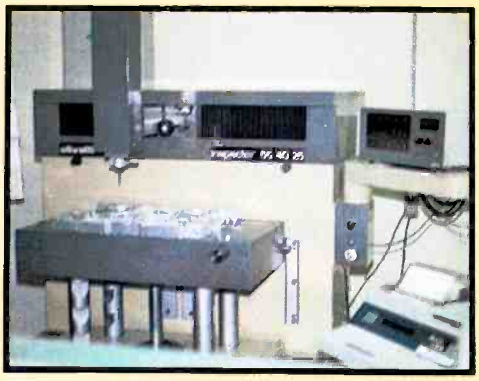
FORTEL

Y-688^{32}
Total Error Corrector



At Regensdorf, in the manufacturing portion of the facility, this diecast deck for a Studer A-800 is automatically inspected for machining accuracy by another computer-controlled device. Attention to the mechanical precision of each component by such machines assures that replacement parts will fit as well as the original ones did.

From another of the many numerically controlled machine tools at Regensdorf comes this machining of a half head shell for a 24-track tape head. This part will go to the Löffingen plant, where the manufacture of the heads is undertaken.

The European style of living is evident in the Studer plant cafeteria. In Switzerland, unemployment is almost non-existent. In fact, there are more jobs than workers, and a company desiring to keep its personnel offers such benefits as a nice place for lunch breaks and good food at an attractive price, in order to maintain morale and employee loyalty.

The author (right) addresses Dr. Willi Studer (far left) on behalf of the group of broadcast and recording industry journalists hosted by his company. As the only group member who knew more than three words of German, he was the unanimous choice to read a prepared thank-you speech in German.

Courtesy of Studer Revox

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Low cost. Fast delivery. Superb quality. Smart reasons to select Shook mobile television production systems. But the real advantage is not how little you'll spend for Shook's totally custom designed vehicles—it's the additional revenues you'll earn by delivering those profitable remote productions. Cost effective? With Shook's low prices and solid reputation for quality and reliability, you couldn't ask for a a better return on your investment!

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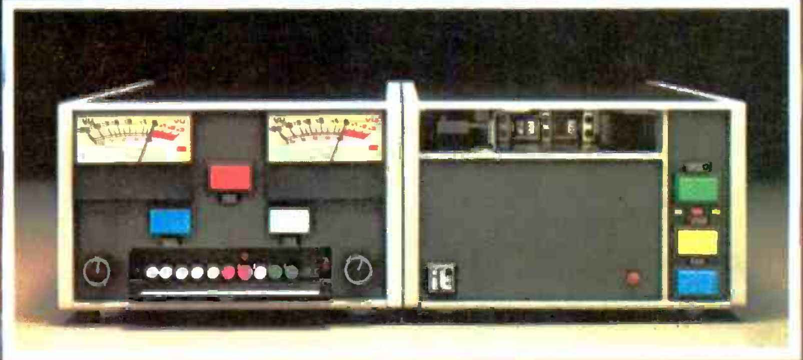

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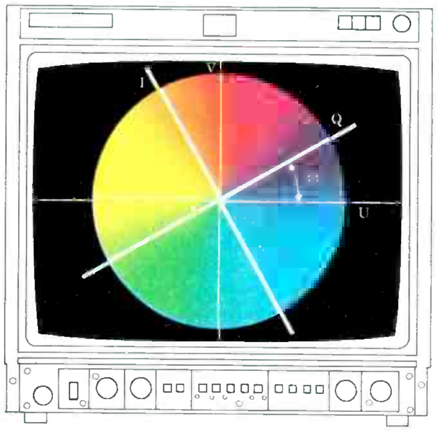

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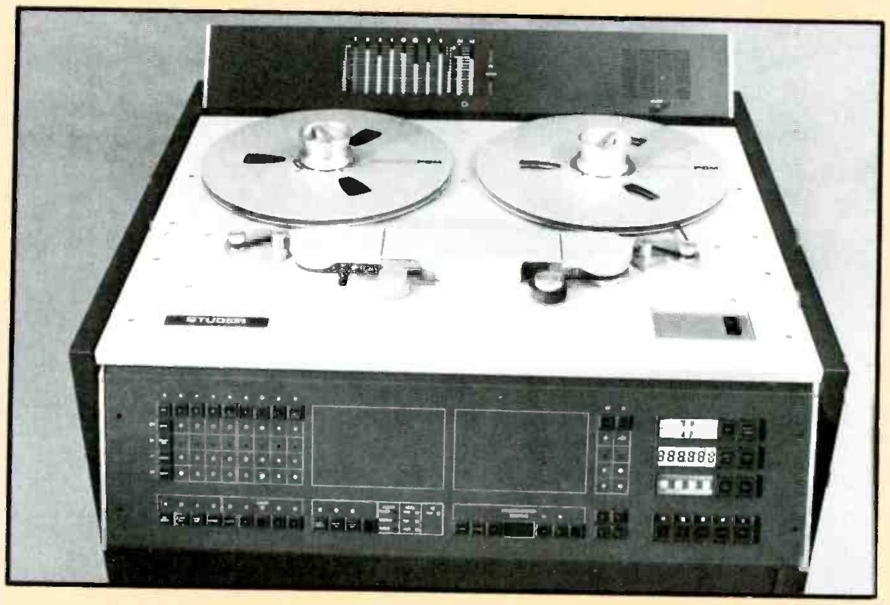
Studer also manufactures mobile broadcasting vans, which are very popular with European radio and TV broadcasters. These units provide broadcasters with quality recording or direct broadcast facilities for operation from any location.

Photos courtesy of Studer Revox



Of special interest during this tour was the engineering laboratory work on this digital recorder. Using pulse code modulation techniques, the recorder puts eight tracks of digital quality audio on ¼-inch tape, running at 30 ips. The first pre-production units should now be in test operation at several European recording studios.

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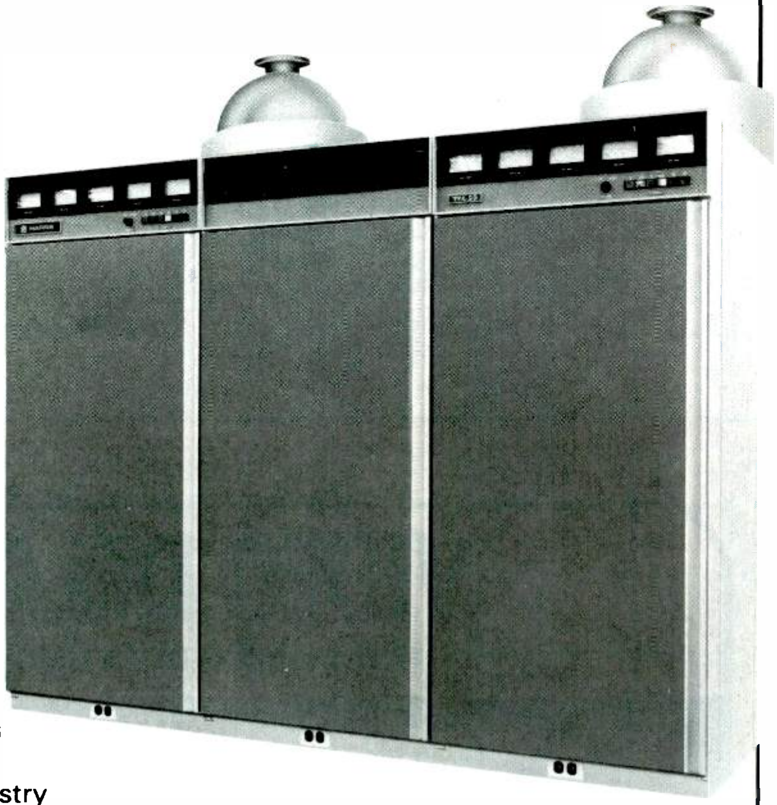

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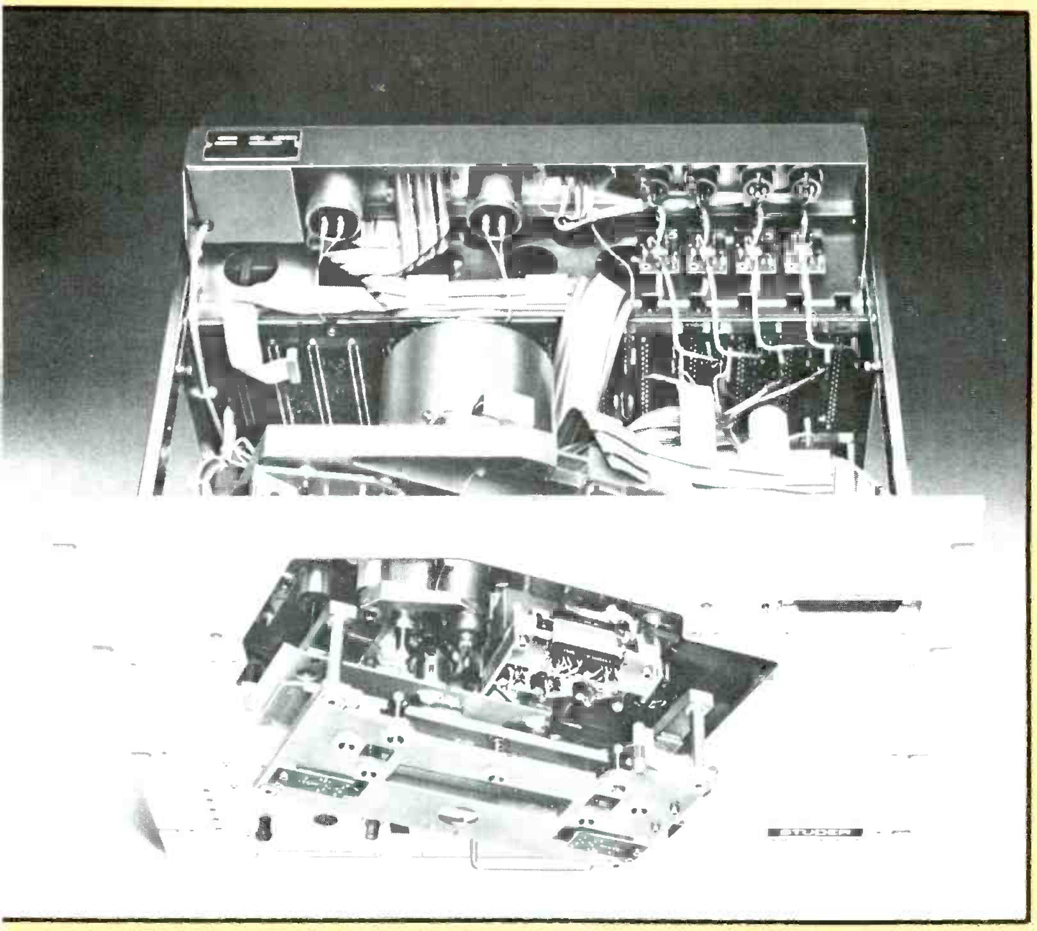

Also new and interesting is the Camos 3000 automation system being developed. It is based on a cassette recorder/player, which is one of the first units built to handle the new Minisette audiocassette. The Minisette is about the size of a ½-inch videocassette and uses ¼-inch tape. A complete system of players and a library of thousands of cassettes was under construction, to be installed by Bavarian Radio. This unit also has another Studer-promoted feature, SMPTE time code information located on a narrow center track. Time code allows cueing accuracy of 100ms.

An interesting experience in the manufacture of high quality audio equipment, the trip to Studer Revox showed us many things: the difference in lifestyle and business climate in another country; the results of carrying out to the last detail a commitment to quality and precision; and the pride that accompanies such an effort.

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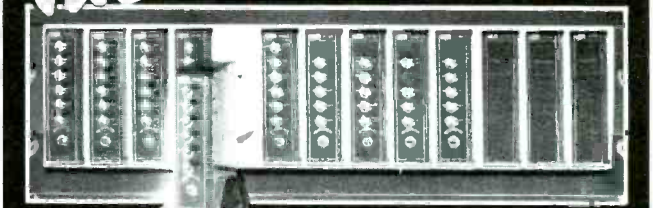

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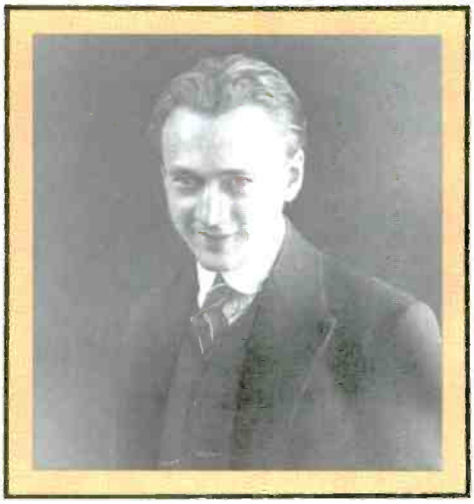


Dr. Vladimir K.

Dr. Vladimir K. Zworykin (ca. 1910), widely acclaimed as the father of television. His *iconoscope* camera tube and *kinescope* picture tube pioneered modern TV equipment.

On July 29, 1982, TV pioneer Dr. Vladimir Kosma Zworykin died at the Princeton Medical Center, Princeton, NJ, a day short of his 93rd birthday.

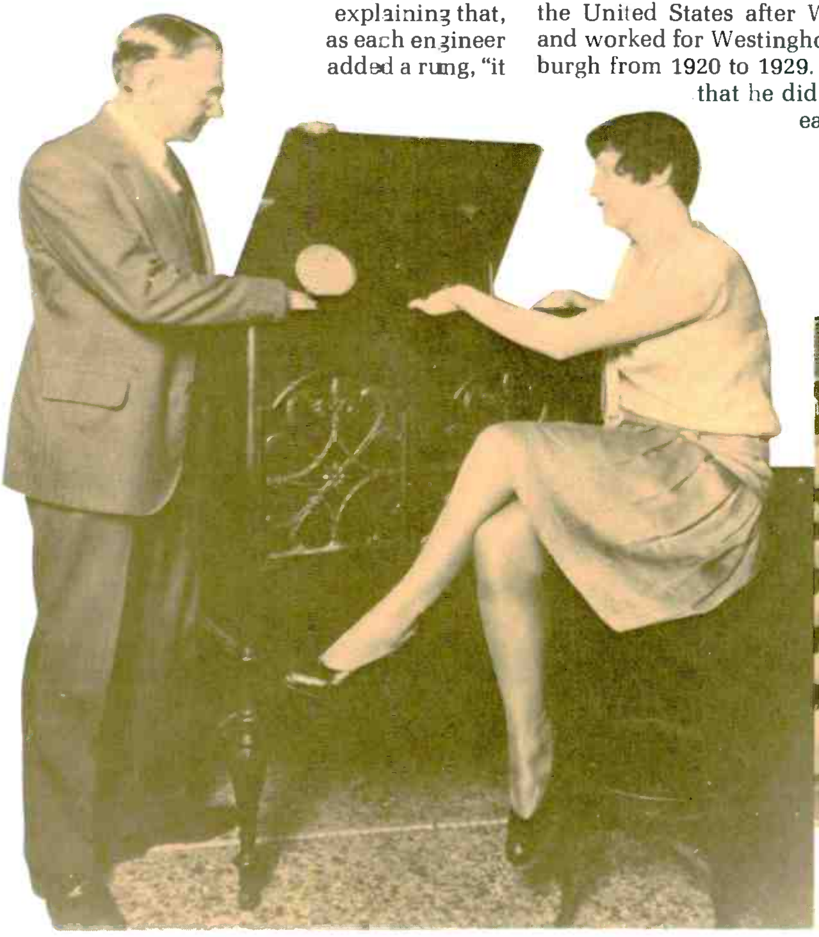
Elected an honorary vice president of the RCA Corporation upon his retirement in 1954, Zworykin was often called the *father of television*. However, he declined the accolade, telling interviewers that hundreds contributed to television's evolvement over many years. He preferred to compare television's development with the building of a ladder, explaining that, as each engineer added a rung, "it enabled the others to climb a little higher and see the next problem a little better."

Father or not, there is no question that the achievement of practical television stems, to a large extent, from Zworykin's pioneering work in the 1920s and 1930s. His conception of the first practical TV camera tube, the *iconoscope*, and his development of the *kinescope* picture tube formed the basis for almost all important later advances in the field.

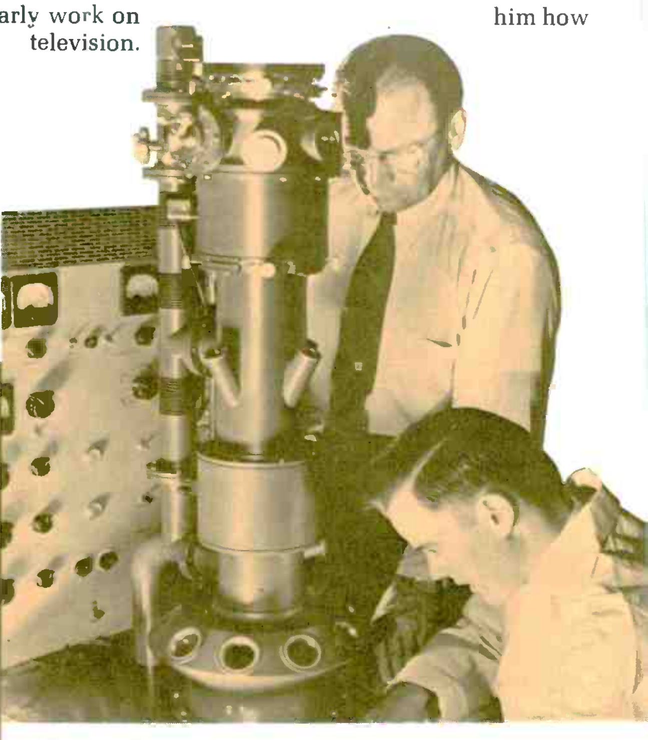
As a Russian immigrant, he came to the United States after World War I and worked for Westinghouse in Pittsburgh from 1920 to 1929. It was there that he did some of his early work on television.

But it was not until he teamed up in 1929 with another Russian immigrant, Gen. David Sarnoff, later president and chairman of RCA, that his TV work got the management and financial backing that enabled Zworykin and the RCA scientists working with him to develop television into a practical system.

Both men never forgot their first meeting. In response to Sarnoff's question, Zworykin, thinking solely in research terms, estimated that the development of television would cost $100,000. Years later, Sarnoff delighted in teasing Zworykin by telling audiences what a great *salesman* the inventor was. "I asked him how



In 1929, Dr. Zworykin demonstrated an early electronic TV receiver using the kinescope picture tube.



An intense scientist and engineer, Dr. Zworykin's interests were wide reaching. He is shown here (standing), with Dr. James Hillier, whom he recruited to develop the electron microscope. For his design of the system's vastly improved objective lens, Hillier was elected to the National Inventors Hall of Fame. (photo ca. 1947)

Zworykin: 1889-1982

much would it cost to develop TV. He told me $100,000, but RCA spent $50 million before we ever got a penny back from television."

Zworykin had left Russia and come to America because he wanted to develop his dream—television. His adopted country treated him well. In 1966, President Lyndon Johnson awarded him the United States' highest scientific honor, the National Medal of Science "for major contributions to the instruments of science, engineering and television, and for his stimulation of the application of engineering to medicine." Including the Medal of Science, Zworykin received 27 major awards and numerous others from groups throughout the world.

He was elected to such prestigious American societies as the National Academy of Sciences, the American Academy of Arts and Sciences, the American Philosophical Society, the American Association of the Advancement of Science and the National Academy of Engineering.

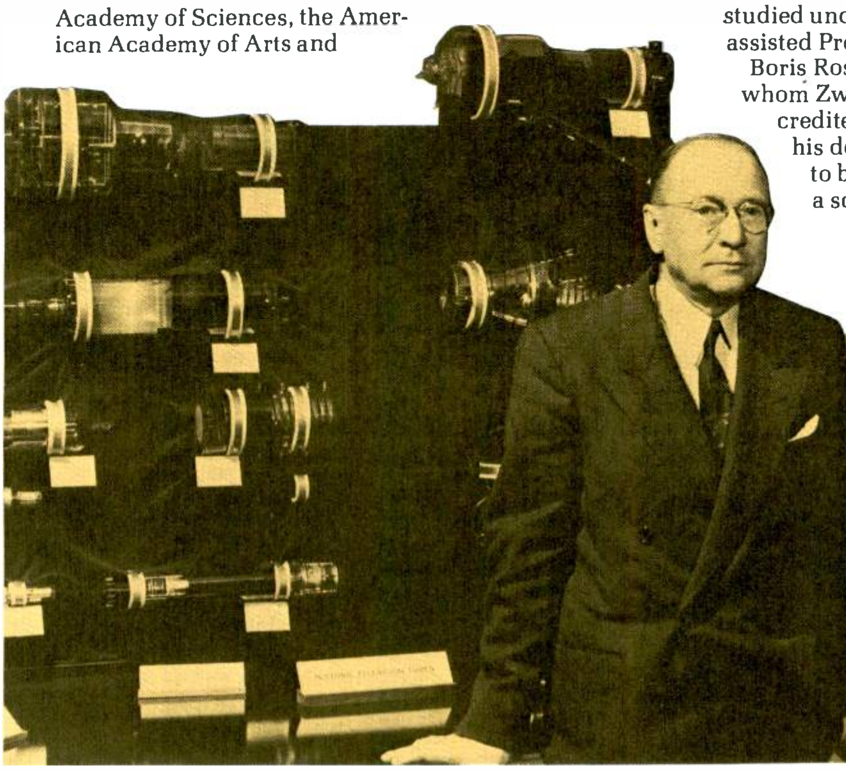
Zworykin was born on July 30, 1889, in Mourom, Russia, where his father owned and operated a fleet of boats on the Oka River. As the owner's son, he had the run of the ships and often played with the push-buttons used to signal the engine room from the bridge. Thus, Zworykin would tell interviewers, he was intrigued with electrical communications well before he was 10 years old.

Perhaps because of this interest in communications, his father sent him to the Petrograd Institute of Technology, which awarded him an Electrical Engineering degree in 1912. At the institute, Zworykin studied under and assisted Professor Boris Rosing, to whom Zworykin credited both his decision to become a scientist and his special interest in television and electronics.

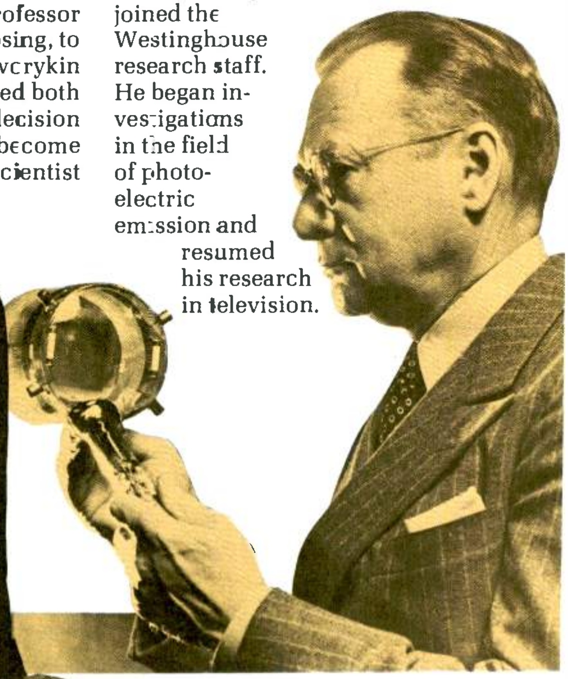
As early as 1906, Rosing believed that the solution to practical television was to be found, not in mechanical systems, but in the employment of cathode ray tubes. Zworykin's iconoscope and kinescope followed this line of reasoning.

In 1912, Zworykin entered the College de France in Paris, where he studied X-rays under the noted scientist Professor Paul Langevin. His studies were interrupted by World War I, and Zworykin had to return to Russia to serve in the Army Signal Corps. After the war, he came to the United States, becoming a citizen in 1924. He received a doctorate from the University of Pittsburgh in 1926.

Soon after arriving in the United States, Zworykin joined the Westinghouse research staff. He began investigations in the field of photoelectric emission and resumed his research in television.



Dr. Zworykin, posing with a display of historic TV tubes.



Dr. Zworykin (ca. 1940s), holding an early model of the iconoscope, which he developed as the *all-electronic eye* of the TV camera.

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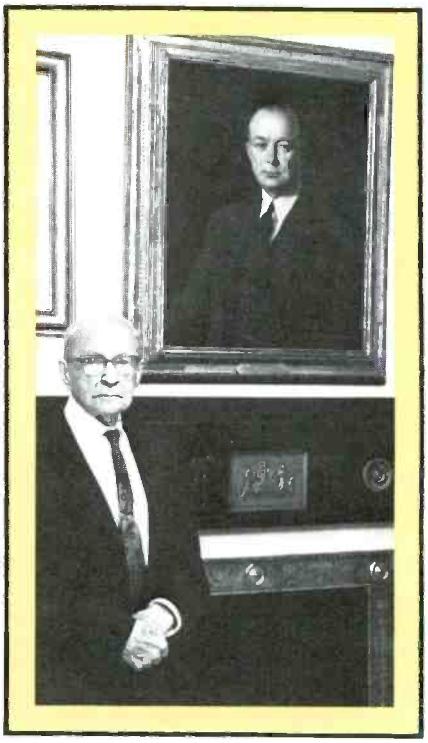
Zworykin became associated with RCA in 1929. He served as director of the Electronic Research Laboratory, first in Camden, NJ, and from 1942 until his retirement, in Princeton, NJ.

In addition to television, Zworykin applied his talents to a broad field of electronics and held more than 120 US patents on developments ranging from gunnery controls to electronically controlled missiles and automobiles.

As a result of Zworykin's research activities, important devices such as various forms of secondary emission multipliers and image tubes were developed and perfected. The Snooperscope and *Sniperscope*—important military developments in World War II—were practical applications of research on infrared image tubes.



Dr. Zworykin (ca. 1980), posing in front of David Sarnoff's portrait. Also a Russian immigrant, Sarnoff was instrumental in bringing Zworykin to RCA, thus providing him the resources to develop electronic television. However, Zworykin credited Sarnoff with having the vision to foresee television as a new form of home entertainment.

Zworykin's intensive study of electron optics directed his interest to the electron microscope. RCA's pioneering in the commercial development of the electron microscope typifies Zworykin's genius—not only his scientific expertise, but his ability to attract and motivate good scientists.

For example, in 1940, he hired a young Canadian graduate student, Dr. James Hillier, to work on the electron microscope. Hillier, who retired in

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And the WR-8716 features plastic conductive faders for greater reliability and smooth, low-noise operation; external power supply for light weight, and switchable 48V DC phantom power for condenser mics.

RAMSA
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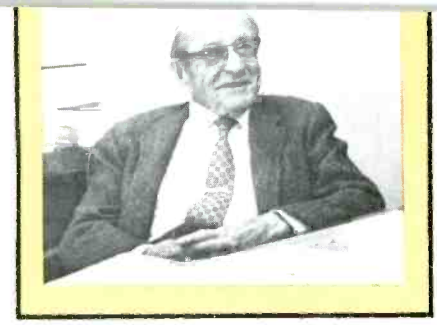

Even though he retired in 1954, Dr. Zworykin maintained an office in the RCA David Sarnoff Research Center in Princeton, NJ, until he was 91 years old. (photo ca. 1980)

1977 as executive vice president and chief scientist of RCA, decided to work for RCA because Zworykin recruited him with one question—how long would it take Hillier to build an electron microscope—while other prospective employers engaged Hillier in theoretical discussions or emphasized their good working conditions and fringe benefits. Working under Zworykin's guidance, it took Hillier little more than three months to build the first RCA electron microscope.

Coincidentally, just three years after Zworykin was elected to the US National Inventors Hall of Fame for his development of television, Hillier was elected, in 1980, for his work on the electron microscope.

For a period of years following his retirement, Zworykin directed a Medical Electronics Center at the Rockefeller Institute in New York. In this capacity, as national chairman of the Professional Group on Medical Electronics of the Institute of Radio Engineers, as founder-president of the International Federation for Medical Electronics and Biological Engineering, and as member of the board of governors of the International Institute for Medical Electronics and Biological Engineering in Paris, he worked toward the use of electronic methods in medicine and the life sciences.

In the fall of 1980, Dr. Zworykin honored the 122nd Technical Conference of the Society of Motion Picture and Television Engineers with a taped interview of early TV developments and with a brief personal address. He is shown here (center), following his speech, talking to Charles Ginsburg (left), of Ampex, and Frederick Remley, than SMPTE vice president for TV affairs. They are gathered around the Emitron camera that served the BBC from 1936 to 1954, the year that Zworykin retired.

Zworykin was often asked if, while working on television, he ever envisioned the worldwide entertainment media it became. He would reply that he hadn't, and credited Sarnoff with seeing television as a new form of home entertainment. Zworykin would then explain that in his early years he looked upon television as a system that would enable man to see things in places where his eyes couldn't reach. Thus, he was delighted with the first TV pictures of the back side of the moon. And, when he visited the Jet Propulsion Laboratories in California to see the reception of pictures of Mars, he remarked, "This is what television is really for."

In October 1980, Dr. Zworykin received a special award from the Eduard Rhein Foundation for his many contributions to fully electronic television. (photo ca. 1970s)

As he grew older, Zworykin curtailed his activities, spending winters in Florida, but never gave up his interest in scientific research. For many years, he was a visiting professor for the Center for Theoretical Studies and the Institute for Molecular and Cellular Evolution of the University of Miami in Florida. And he maintained an office at RCA Laboratories. Even at the age of 91, he would drive from his home in Princeton to his office in the David Sarnoff Research Center to read from his large collection of scientific journals and reports.

It was in that office, after Zworykin's 85th birthday, that a *New York Times* reporter asked Zworykin: "You've been involved in scientific research for many, many years. When are you going to stop working and really retire?"

A smile gathered quickly on Zworykin's face, and he replied without hesitation, "When I die."

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For complete product information and a report on why WDEL's Bob Taylor chose four Auditronics 200 Series consoles for his new facilities, contact:

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The composite signal: Key to quality FM broadcasting

By Geoffrey N. Mendenhall, P.E., vice president of engineering, Broadcast Electronics, Quincy, IL

The author, delivering portions of this paper at the WOSU Second Annual Broadcast Engineering Conference, July 20-22, 1982, at Ohio State University, Columbus, OH.

"The Composite Signal: Key to Quality FM Broadcasting" is oriented toward helping the station engineer understand how the transmission system affects the composite signal. Techniques are suggested for the station engineer to improve performance of existing equipment.

This discussion of the FM composite baseband deals more with the practical, operational aspects of an FM transmitting system rather than an in-depth, theoretical analysis of the modulation/demodulation process.

The FM composite signal is the sum of all the individual components that make up a multiplex system. FM broadcasting usually includes these individual components:

- L + R information at the audio modulating frequencies (30Hz to 15kHz);
- the 19kHz pilot tone;
- L − R information at 38kHz plus and minus the audio modulating frequencies (23kHz to 53kHz); and
- the 67kHz FM modulated SCA subcarrier (53-81kHz).

Figure 1 shows the composite baseband viewed on an oscilloscope with peak-to-peak amplitude shown as a function of time. Figure 2 shows the

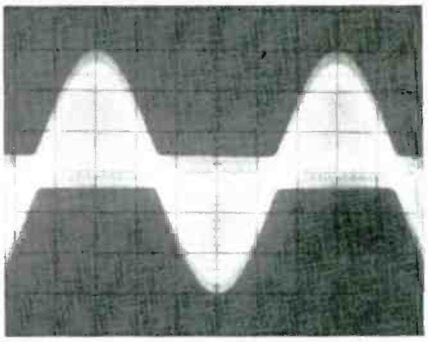
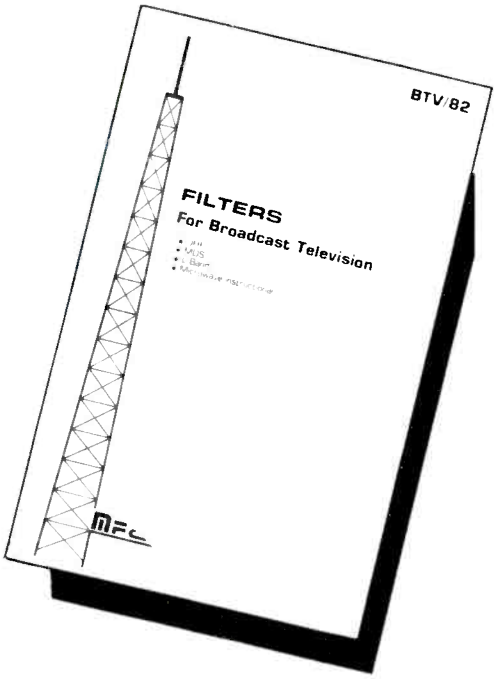


Figure 1. Time domain scope waveform of composite baseband containing stereo (one channel only at 10kHz) plus unmodulated 67kHz. Output taken from composite test jack on BEI's FX-30 exciter driven by the FS-30 stereo generator and the FC-30 SCA generator.



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The Ramko DC-38 Series consoles are known to be highly interference free because we don't let RF and scratchy pots and switches attack the audio. All audio functions, from switching through attenuation are done via D.C. control.

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Inputs:	Up to 4 per mixer, balanced bridging
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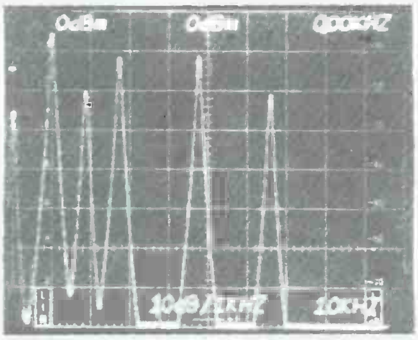


Figure 2. Frequency domain spectrum of composite baseband containing stereo (one channel only at 10kHz) plus unmodulated 67kHz SCA. Spectrum at composite test jack on BEI's FX-30 exciter driven by the FS-30 stereo generator and the FC-30 SCA generator.

composite baseband as viewed on a low frequency spectrum analyzer. This is a representation of amplitude as a function of frequency. It is now easy to identify the various frequency components within the baseband.

Non-linearity within the modulation/demodulation process will alter the composition of the baseband, resulting in distortion of the demodulated signal.

Signal degradation

Let's assume that we have a perfect demodulator, and focus our attention on the transmission portion of the total system. Also assume that we have perfect output signals from the stereo and SCA generators. Now there are only three areas in which signal degradation could occur. Each of these areas has its own special effect on the baseband signal. The areas are:

- the composite link to the FM modulator (stereo generator, SCA generator, composite processor and STL equipment);
- the FM modulator; and
- the RF path to the demodulator (FM exciter, IPA, PA and antenna system).

The composite link

The composite path from the stereo and SCA generators to the FM modulator should be linear in both amplitude vs. frequency and in phase vs. frequency response. Simply stated, this means that no frequency component within the baseband should be attenuated more than any other frequency component. Furthermore, all frequency components should propagate through the system at the same speed (constant group delay) and thus arrive at the modulator at the same time. The accompanying first set of equations mathematically relates stereo separation to *amplitude* response. The second set mathematically relates stereo

Stereo separation as a function of amplitude response.

$$\text{Separation}(A,\theta) = \left[\frac{(\cos\theta + A)^2 + (\sin\theta)^2}{(\cos\theta - A)^2 + (\sin\theta)^2}\right]^{1/2}$$

General Form

$$\text{Separation}(A) = \left[\frac{(1+A)^2}{(1-A)^2}\right]^{1/2}$$

If $\theta = 0$ (Perfect Phase)

Stereo separation as a function of phase response (group delay).

$$\text{Separation}(A,\theta) = \left[\frac{(\cos\theta + A)^2 + (\sin\theta)^2}{(\cos\theta - A)^2 + (\sin\theta)^2}\right]^{1/2}$$

General Form

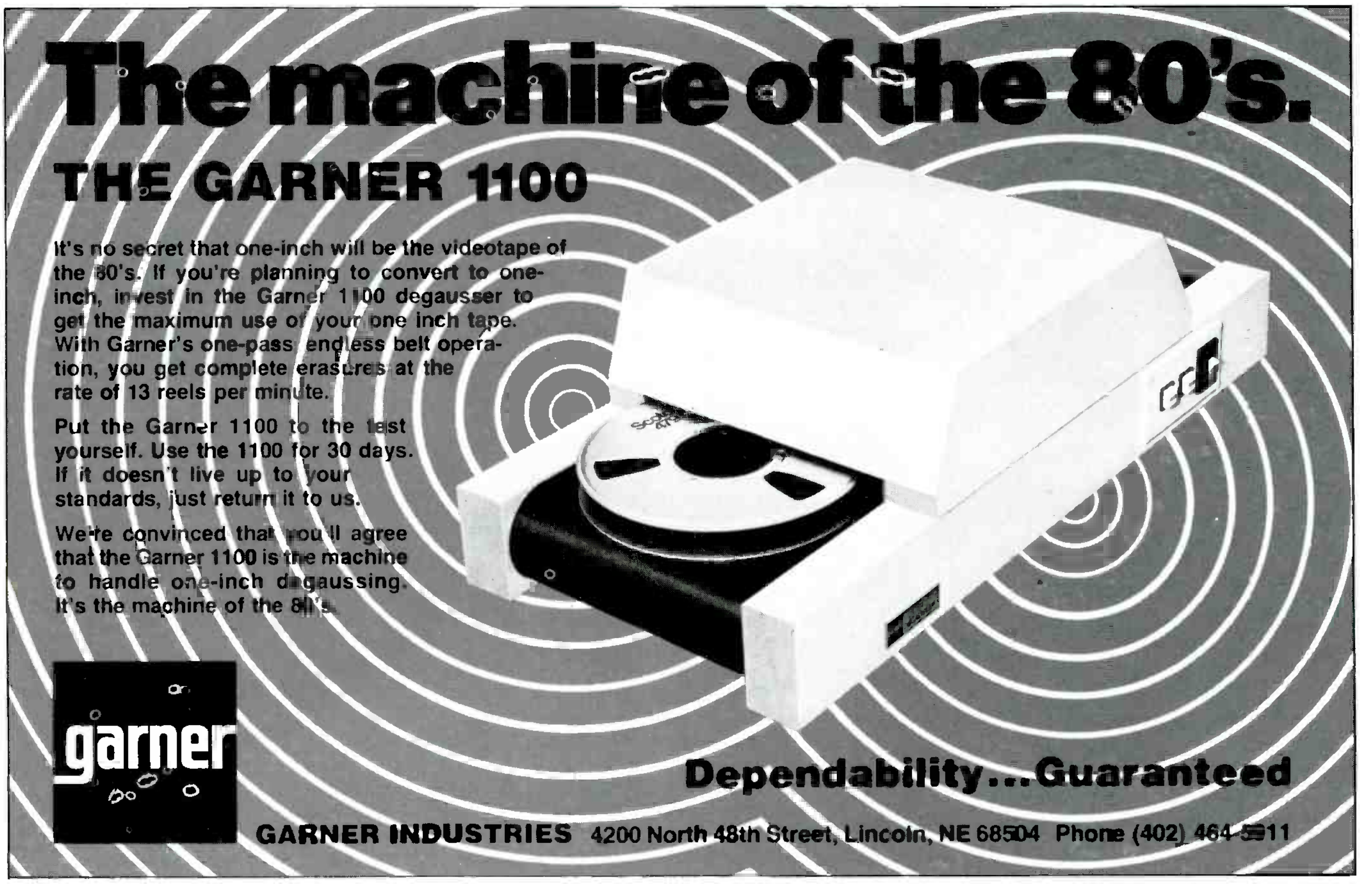
$$\text{Separation}(\theta) = \left[\frac{(\cos\theta + 1)^2 + (\sin\theta)^2}{(\cos\theta - 1)^2 + (\sin\theta)^2}\right]^{1/2}$$

If $A = 1$ (Perfect Amplitude)

In each equation:

θ = Phase error in degrees

$A = \frac{\text{Sub}}{\text{Main}} = \frac{L-R}{L+R}$ = Amplitude Ratio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Phase Correction: (Stereo)	±738° correction range @ 16kHz
Separation (Stereo):	50 dB
Output Level:	+25 dBm
Distortion:	0.3% max. (amplifier)
Price:	$1,091 Model PM-1 Mono Playback $2,600 Model RPS-1 Stereo—Record/Play $2,000 Model RPM-1 Mono Record/Play $1,399 Model PS-1 Stereo Playback

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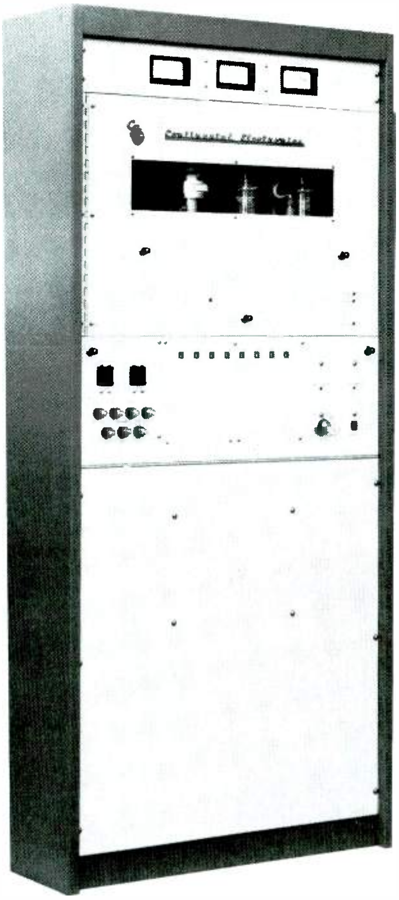

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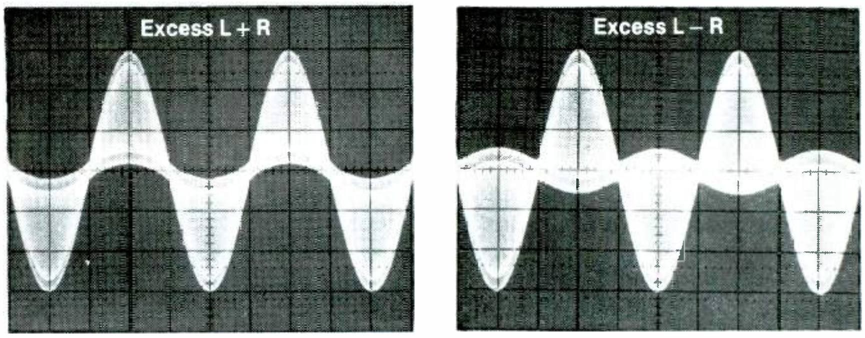
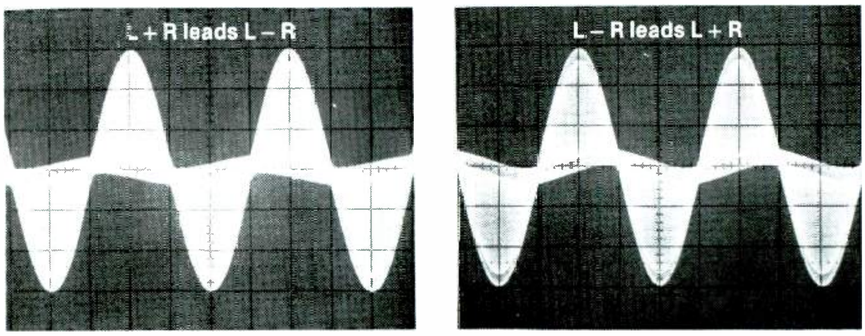


Figures 3 and 4. Time domain pictures of non-ideal amplitude response.



Figures 5 and 6. Time domain pictures of non-ideal phase response.

separation to *phase* response.

Correct phasing and equal group delay of the pilot tone is also essential to achieving stereo separation. Figures 3-6 show non-ideal amplitude and phase response.

The final stereo performance of the complete system will be determined by the algebraic summation of the individual composite amplitude response and composite phase response of each device within the composite signal path.

The exciter, STL link and any other composite device should specify these composite performance parameters so that total system performance can be easily predicted. In order to maintain a system separation of greater than 45dB, the composite amplitude response must be within ± 0.07dB or less, 30Hz to 53kHz, and the composite phase response must be less than ± 0.45° from linear phase, 30Hz to 53kHz, as calculated in Figure 7.

$$\text{Separation}(A,\theta) = \left[\frac{(\text{COS}\theta + A)^2 + (\text{SIN}\theta)^2}{(\text{COS}\theta - A)^2 + (\text{SIN}\theta)^2}\right]^{1/2}$$

Where A = 0.99209 or 1.00798 (±0.069dB)
And θ = ±0.45°
$S(A,\theta)$ = Separation as a function of A and θ

$$S(A,\theta) = \left[\frac{(\text{COS } 0.45° + 0.99209)^2 + (\text{SIN } 0.45°)^2}{(\text{COS } 0.45° - 0.99209)^2 + (\text{SIN } 0.45°)^2}\right]^{1/2} \approx 179$$

$$S(\text{dB}) = 20 \text{ Log}_{10}(179) = 45.06\text{dB Separation}$$

Figure 7. Calculated separation

An amplitude and delay equalizer for the composite baseband is now available as part of the stereo generator. Equalization for amplitude and phase deficiencies in the STL or exciter will improve the overall system performance. An FM exciter with flat amplitude and phase response using a balanced composite input will avoid ground loop problems as well as minimize equalization requirements.

The use of any non-linear devices, such as clippers or limiters, in the composite line will alter not only the peak amplitude of the baseband, but also the frequency spectrum of the baseband. This generates several types of distortion at the receiver.

Figures 9 and 10 show the waveform and spectrum of unprocessed baseband, while Figures 11 and 12

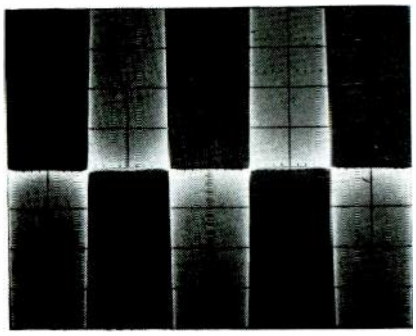


Figure 8. Stereo waveform with correct amplitude and phase response. Shows output of BEI FS-30 stereo generator, with waveform expanded 10 times and pilot excluded for examination of baseline flatness.

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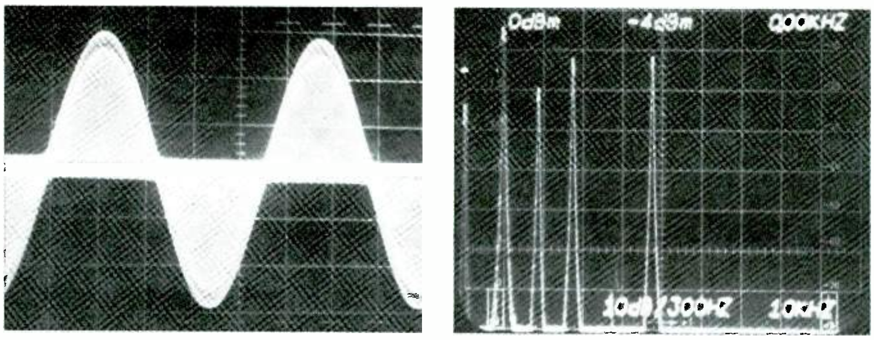
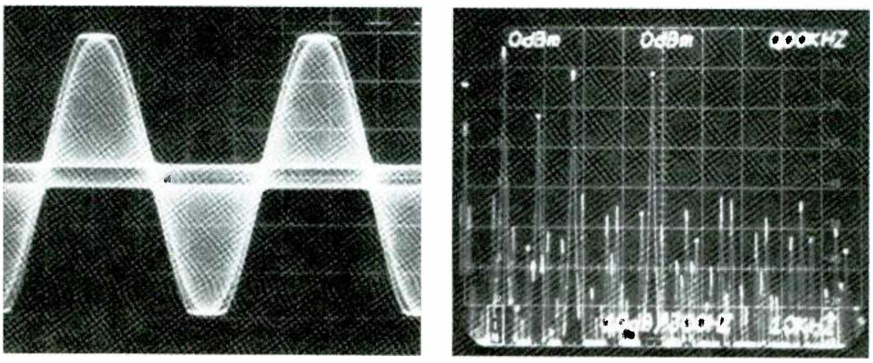


Figures 9 and 10. Baseband without clipping (output from BEI FS-30 stereo generator, one channel only, modulated at 10kHz).



Figures 11 and 12. Baseband after 1.25dB composite clipping. Output is from the BEI FS-30 stereo generator followed by 1.25dB of composite clipping, one channel only, modulated at 10kHz.

show the same waveform and spectrum after 1.25dB of composite clipping.

The following are types of distortion caused by composite processing:

- intermodulation of all baseband frequency components causing extraneous spectral components;
- harmonic distortion of baseband causing degradation of crosstalk and separation; and
- modulation of pilot injection level causing loss of lock at the synchronous detector.

The received audio is high in intermodulation distortion and noncorrelated information due to aliasing of the extraneous spectral components added by composite processing.[1 2]

If minimum system distortion is the goal, composite processing should not be used. Audio processing should be performed before the audio is multiplexed into baseband.

Distortion of the composite baseband signal can also be caused by transient intermodulation distortion (TIM) within the amplifier stages.

Transient intermodulation distortion of the baseband signal is caused by the same mechanisms that produce TIM in audio signals. The composite amplifiers must have sufficient feedback bandwidth to accept

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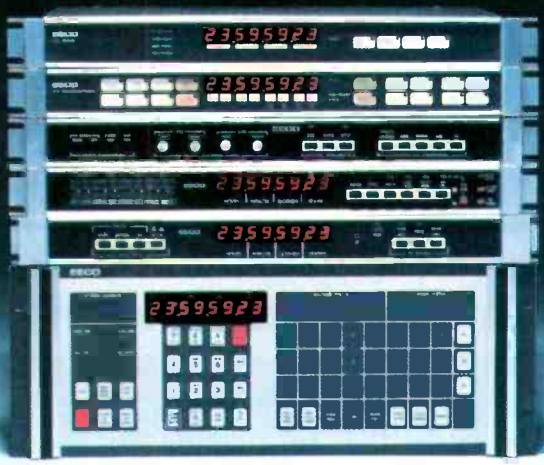

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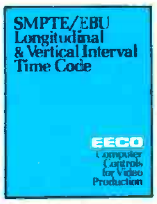

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baseband frequencies to 100kHz and should slew symmetrically to minimize slew-induced distortion. The TIM performance becomes largely a matter of operational amplifier selection and circuit configuration.

FM modulator linearity

The composite baseband signal is translated to a frequency-modulated carrier frequency by the modulated oscillator. Frequency modulation is produced by applying the composite baseband signal to a voltage-tunable RF oscillator. The modulated oscillator usually operates at the carrier frequency and is voltage-tuned by varactor diodes, operating in a parallel LC circuit.

To have perfect modulation linearity, the RF output frequency must change in direct proportion to the composite modulating voltage applied to the varactor diodes. This requirement implies that the capacitance of the varactor diodes must change as nearly the square of the modulating voltage as shown in the accompanying equations.

Unfortunately, the voltage vs. capacitance characteristic of practical varactor diodes is not the desired square law relationship. All varactor-tuned oscillators have an inherently non-linear modulating characteristic. This non-linearity is predictable and repeatable for a given circuit configuration, making correction by complementary predistortion of the modulating signal feasible.[3] Suitable predistortion can be applied by using a piece-wise linear approximation to the desired complementary transfer function. Figure 13 shows a network of switching diodes and resistors for complementary predistortion of the composite baseband.

$f_c \propto V_m$ (Desired linear voltage to frequency translation)

$$f_c = \frac{1}{2\pi\sqrt{LC_T}}$$

$$C_V \propto \frac{1}{(V_m)^2} \quad (\text{If } C_{Fixed} \ngtr 0)$$

Where: f_c = Instantaneous carrier frequency
V_m = Baseband modulating voltage
L = Inductance of resonant circuit
C_T = Total capacitance across L ($C_{Fixed} + C_{Varactors}$)
C_V = C of Varactor tuning diodes

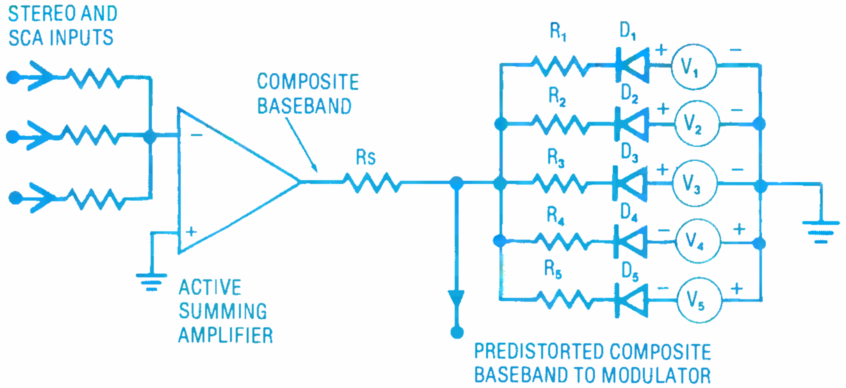

Figure 13. Predistortion network

Figure 14 shows how the predistortion network is cascaded with a non-linear voltage-tuned oscillator to produce a linearized FM modulator.

Modulator linearization has reduced harmonic and intermodulation distortion to less than 0.05% in newly developed equipment.

Any distortion of the baseband signal caused by the modulated

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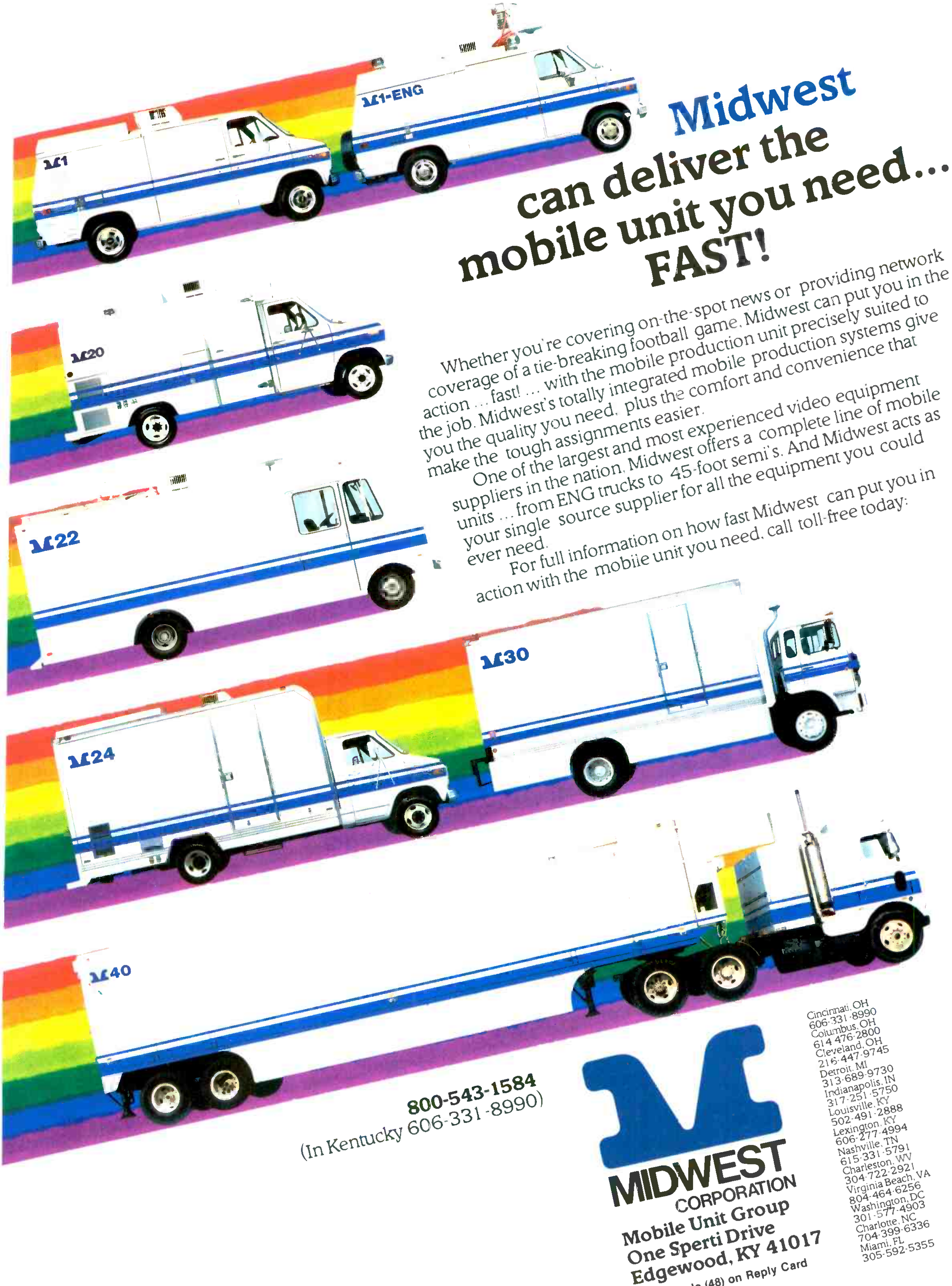

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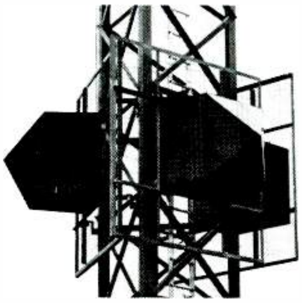

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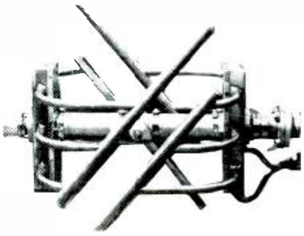

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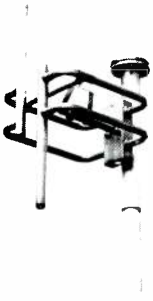

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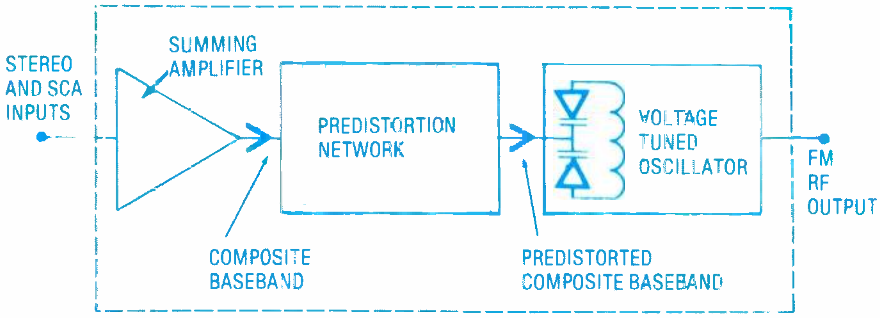

Figure 14. Linearized FM modulator block diagram

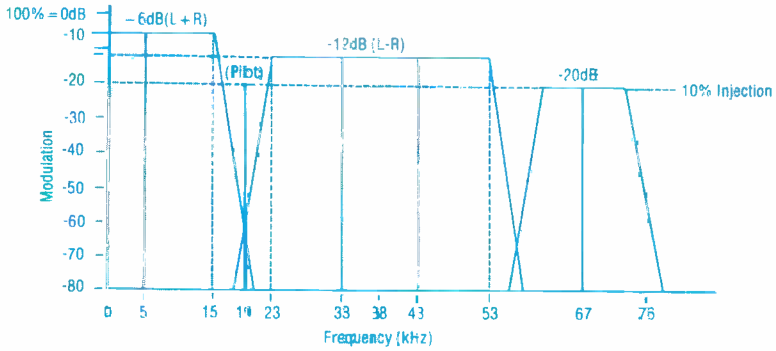

Figure 15. Ideal demodulated composite baseband spectrum with no modulator distortion. L or R only modulated 100% at 5kHz. Unmodulated SCA at 10% injection.

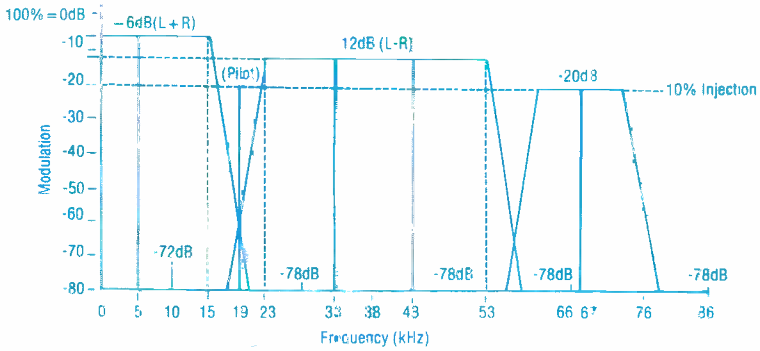

Figure 16. Demodulated composite baseband spectrum with 0.05% harmonic distortion in modulator. L or R only modulated 100% at 5kHz. Unmodulated SCA at 10% injection. Interfering second harmonic stereo sidebands are 58dB below SCA. Only fundamental and second harmonic terms are shown.

oscillator will have secondary effects on stereo and SCA crosstalk, which are quite noticeable at the receiver in spite of the small amounts of distortion to the baseband. For example, if the harmonic distortion to the baseband is increased from 0.05% to 1%, as much as 26dB additional crosstalk into the SCA can be expected.

For illustrative purposes, Figures 15, 16 and 17 give representations of the fundamental and second order terms in the composite baseband spectrum with increasing amounts of harmonic distortion in the modulated oscillator.

Figure 16 shows this spectrum after 0.05% harmonic distortion has been added to each component. Note that the second order stereo (L − R) sidebands are 78dB below 100% modulation or about 58dB below a 67kHz SCA with a 10% injection. With normal energy distribution in L − R and the SCA, crosstalk from stereo into the SCA will be more than 60dB below the SCA subcarrier. Figure 17 shows the same baseband spectrum with 1% harmonic distortion. The second order stereo sidebands are only 32dB below the SCA. Crosstalk may now increase as much as 26dB, depending on the respective energy distributions in (L − R) and the SCA.

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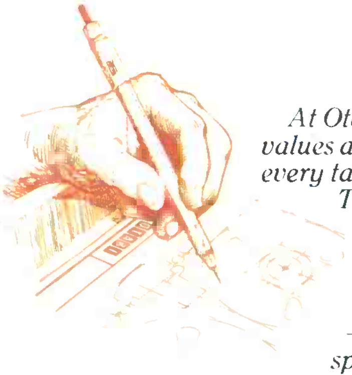

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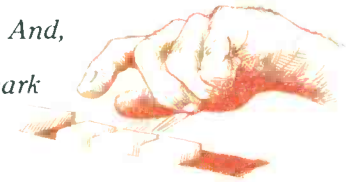

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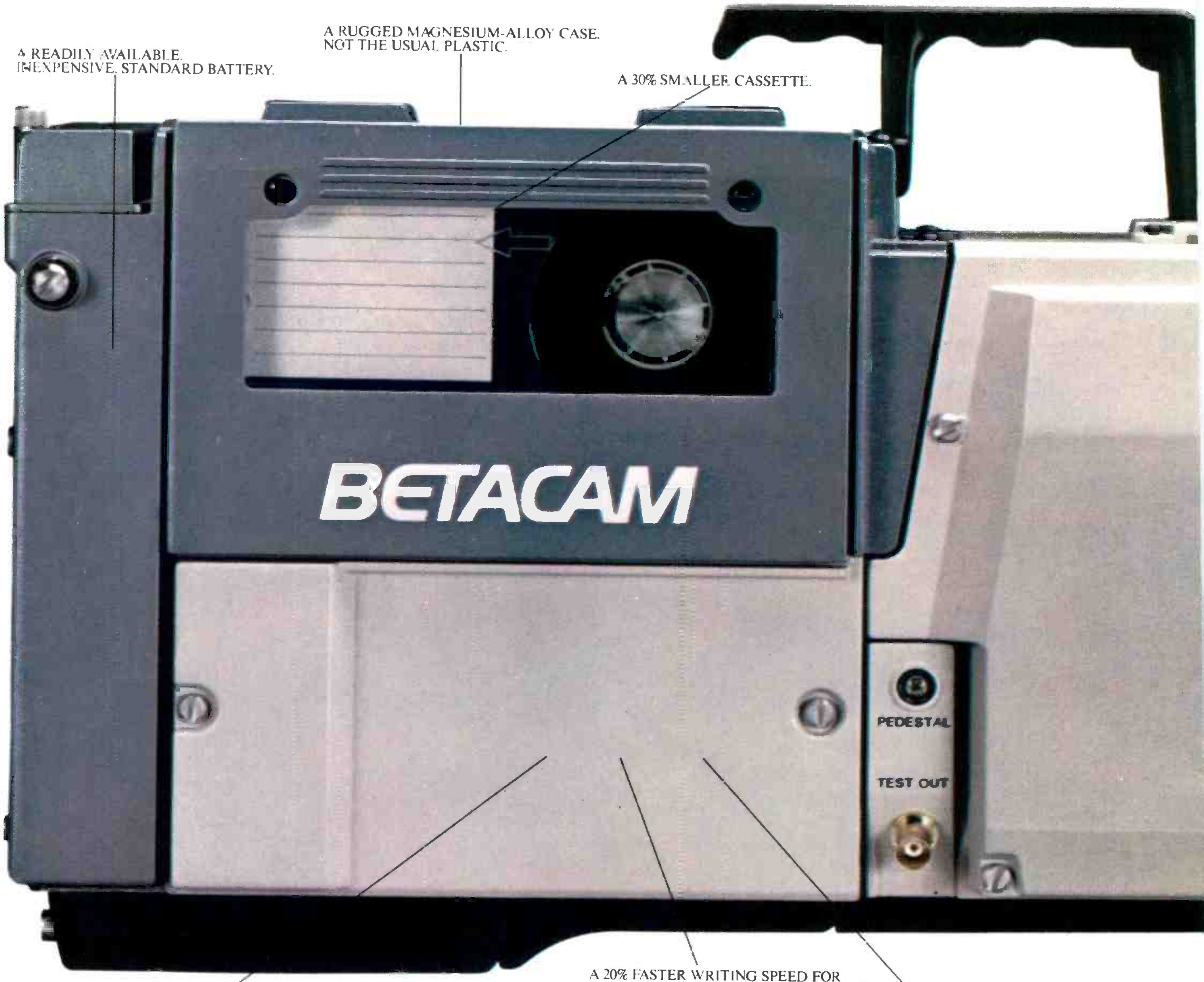

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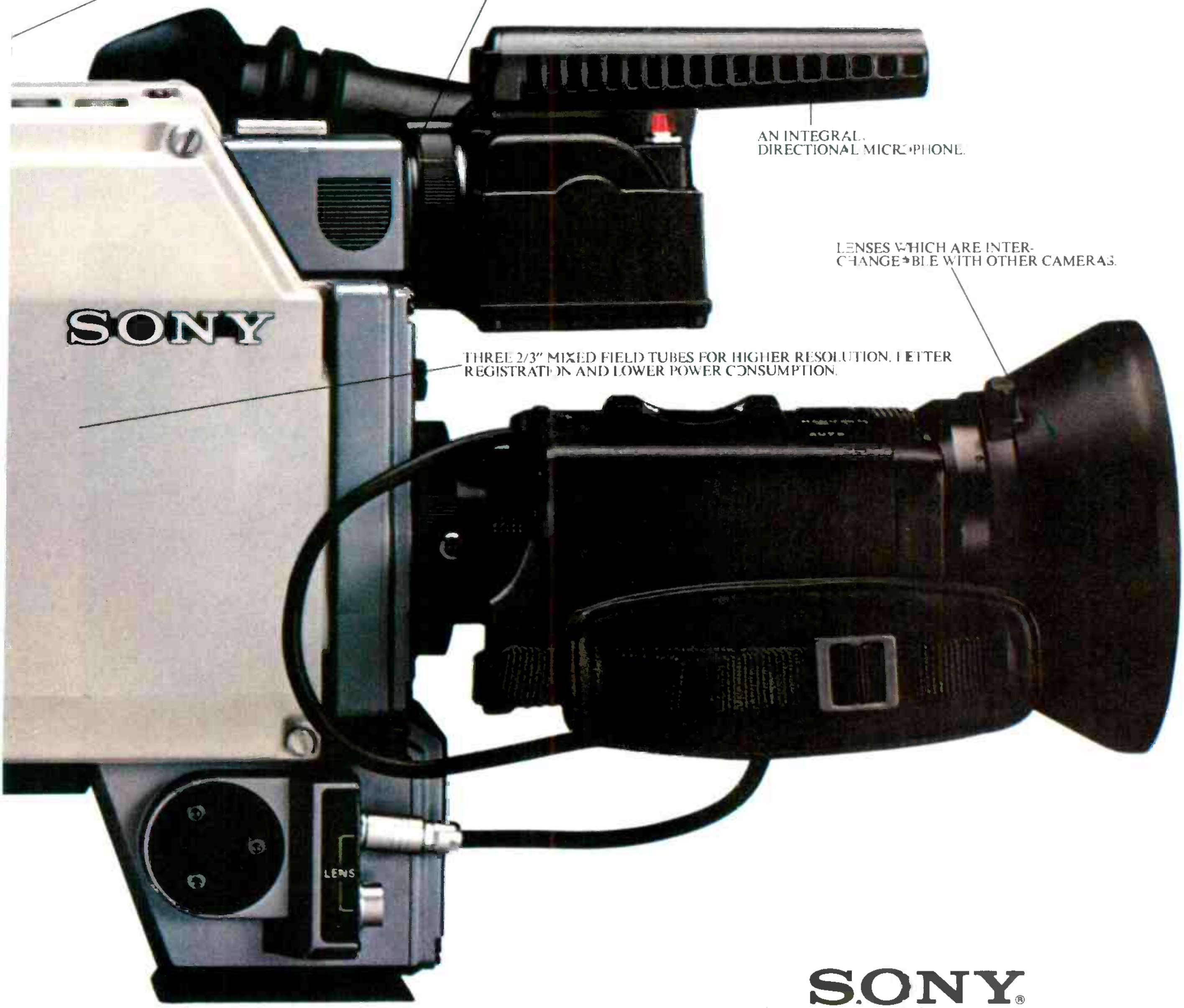

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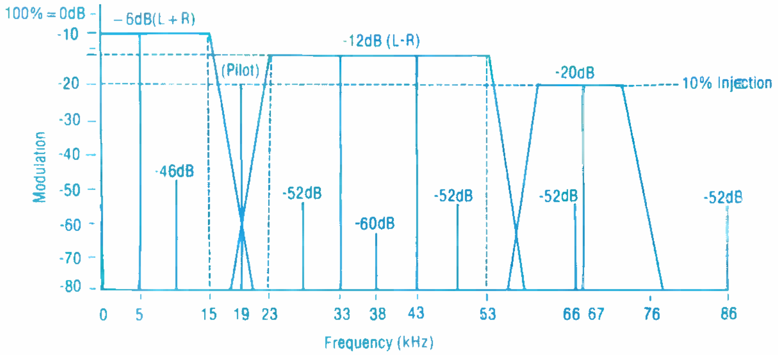


Figure 17. Demodulated composite baseband spectrum with 1% harmonic distortion in modulator. L or R only modulated 100% at 5kHz. Unmodulated SCA at 10% injection. Interfering second harmonic stereo sidebands are 32dB below SCA. Only fundamental and second harmonic terms are shown.

Simplified Bessel Function

$$\begin{aligned} E = A\ \{&J_0(M)\mathrm{SIN}\omega_c(t) \\ &+ J_1(M)[\mathrm{SIN}(\omega_c+\omega_m)t - \mathrm{SIN}(\omega_c-\omega_m)t] \\ &+ J_2(M)[\mathrm{SIN}(\omega_c+2\omega_m)t + \mathrm{SIN}(\omega_c-2\omega_m)t] \\ &+ J_3(M)[\mathrm{SIN}(\omega_c+3\omega_m)t - \mathrm{SIN}(\omega_c-3\omega_m)t] \\ &+ \ldots\} \end{aligned}$$

Where: A = Unmodulated carrier amplitude

J_0 = Modulated carrier amplitude

$J_1, J_2, J_3, \ldots J_n$ = Amplitude of nth order sidebands

ω_c = $2\pi f_c$ (carrier frequency)

ω_m = $2\pi f_m$ (modulating frequency)

$M = \dfrac{\Delta f}{f_m}$, The modulation index

suppress undesired harmonic and intermodulation products in the baseband, making the FM exciter transparent to the signals coupled into it.

TIM distortion is usually not a factor in varactor-tuned modulated oscillators. The modulation bandwidth capability is generally more than 10 times the composite bandwidth and no negative feedback is used to maintain linearity.

The RF path

The FM modulator converts the composite baseband signal into the frequency-modulated RF signal containing a complex array of sidebands[4]. The amplitude and phase of the FM sidebands are determined by the modulation index, while the frequencies of the sidebands are determined by the modulating frequencies.

If the modulating frequency and the FM frequency deviation are known, the modulation index can be calculated as shown in the following equation.

$$M = \frac{\Delta f}{f_m}$$

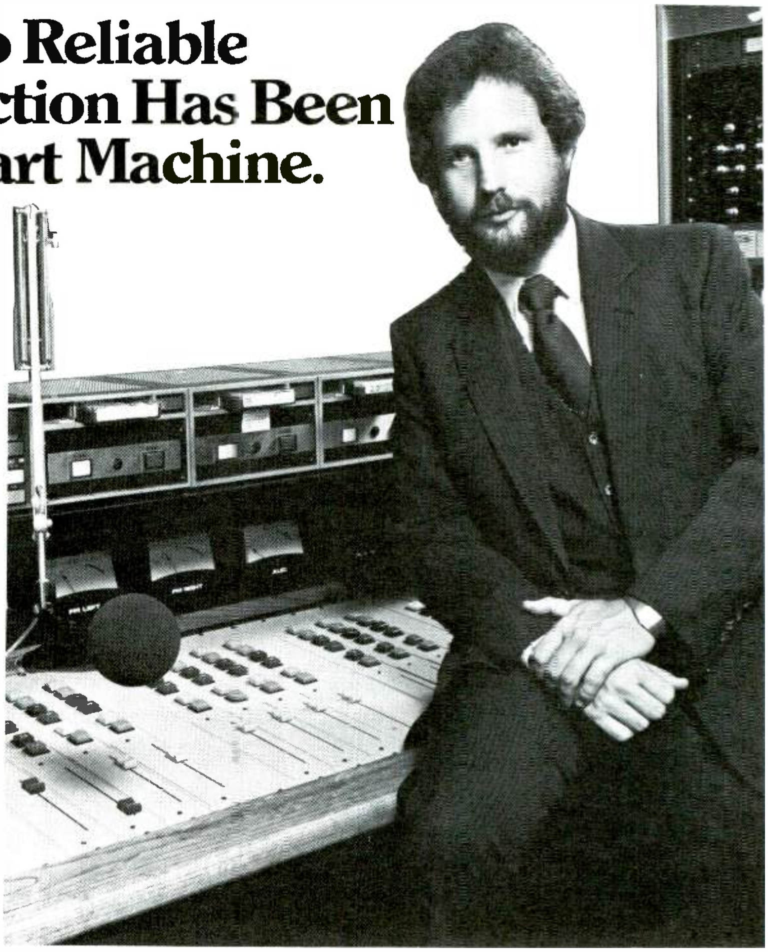
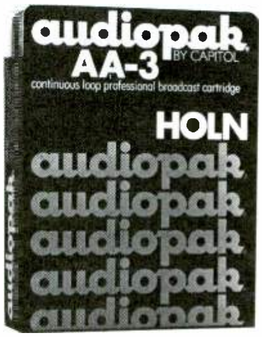
Where: M = Modulation index

Δf = Frequency deviation

f_m = Modulating frequency

By making the modulation index (M) the argument of a Bessel function, as shown in the above equation, we can determine the amplitude and phase of the carrier (J_0) as well as the higher order sidebands (J_1 thru J_n).

Figure 18 is a graphical representation of the Bessel functions for the first eight orders.[5] Figure 19 shows the frequency spectrum for a modulation index of 2.405, which is the first carrier (J_0) null. After examining the Bessel function and the resulting spectra in Figures 18 and 19, it becomes clear that the occupied bandwidth of an FM signal is far greater than the amount of deviation from the carrier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CV-2250	3CX10,000U7	170–227	10 kW†
CV-2400	8874	420–450	300/1250 W*
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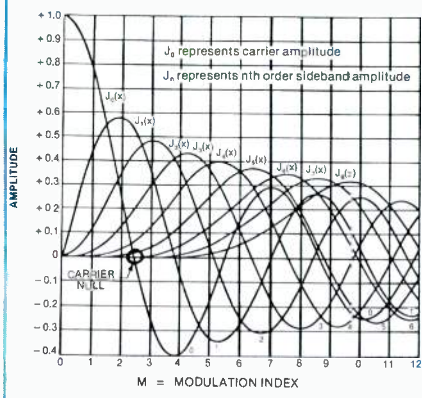
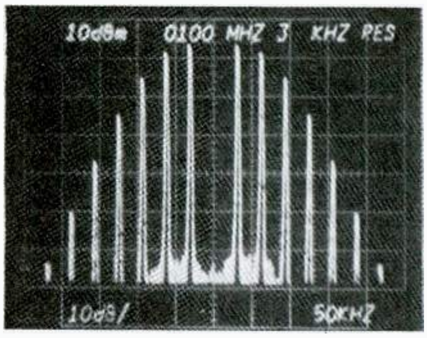


Figure 18. Amplitude of the carrier and the first eight sidebands as a function of modulation index.

frequency. The occupied bandwidth is actually infinite if all the sidebands are taken into account. It is also interesting to note that at certain modulation indices, the carrier amplitude goes to zero with all the transmitted power distributed at frequencies other than the carrier frequency. This carrier null phenomenon is useful as an extremely accurate method for the calibration of modulation monitors. (See carrier null in Figure 19.)

We have established that the FM spectrum occupies a bandwidth far greater than the deviation width that one might incorrectly assume is the bandwidth.

Practical considerations in the transmitter RF circuitry make it necessary to restrict the RF bandwidth to less than infinity. As a result, the higher order sidebands will be altered in amplitude and phase. Bandwidth limitation will add to the distortion in any FM system.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3 KHZ RES
10dB/
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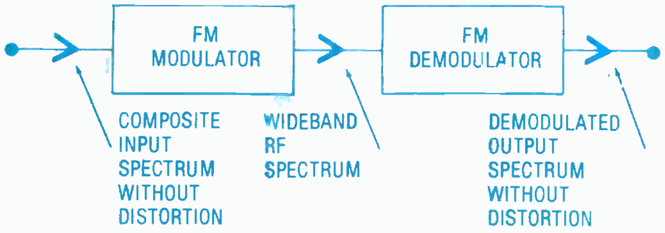
Figure 19. FM RF spectrum showing occupied bandwidth and Bessel null single tone at ±75kHz deviation. (For M = 2,405, f_M31,185Hz, f_C100MHz).

Consider the model shown in Figure 20, where a perfect FM modulator is connected to a perfect demodulator via an RF path of infinite bandwidth. The demodulated audio contains no distortion components.

In Figure 21, a passive LC bandpass filter is inserted between the modulator and demodulator in order to restrict the bandwidth. Audio distortion products now appear at the output of our perfect demodulator, due solely to the bandwidth restriction imposed by the passive BPF. The distortion in any practical FM system will depend on the amount of bandwidth available vs. the modulation index being transmitted.

Relating the specific quantitative effect of the bandwidth limitations imposed by a particular transmitter to the actual distortion of the demodulated composite baseband is a complicated problem indeed. The following are some of the factors involved:

- total number of tuned circuits involved;
- amplitude and phase response of the total combination of tuned circuits in the RF path;
- amount of drive (saturation effects)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FM DEMODULATOR
COMPOSITE INPUT SPECTRUM WITHOUT DISTORTION
WIDEBAND RF SPECTRUM
DEMODULATED OUTPUT SPECTRUM WITHOUT DISTORTION

Figure 20. Wideband RF path

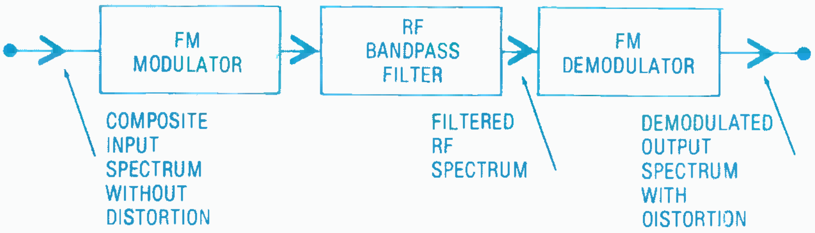
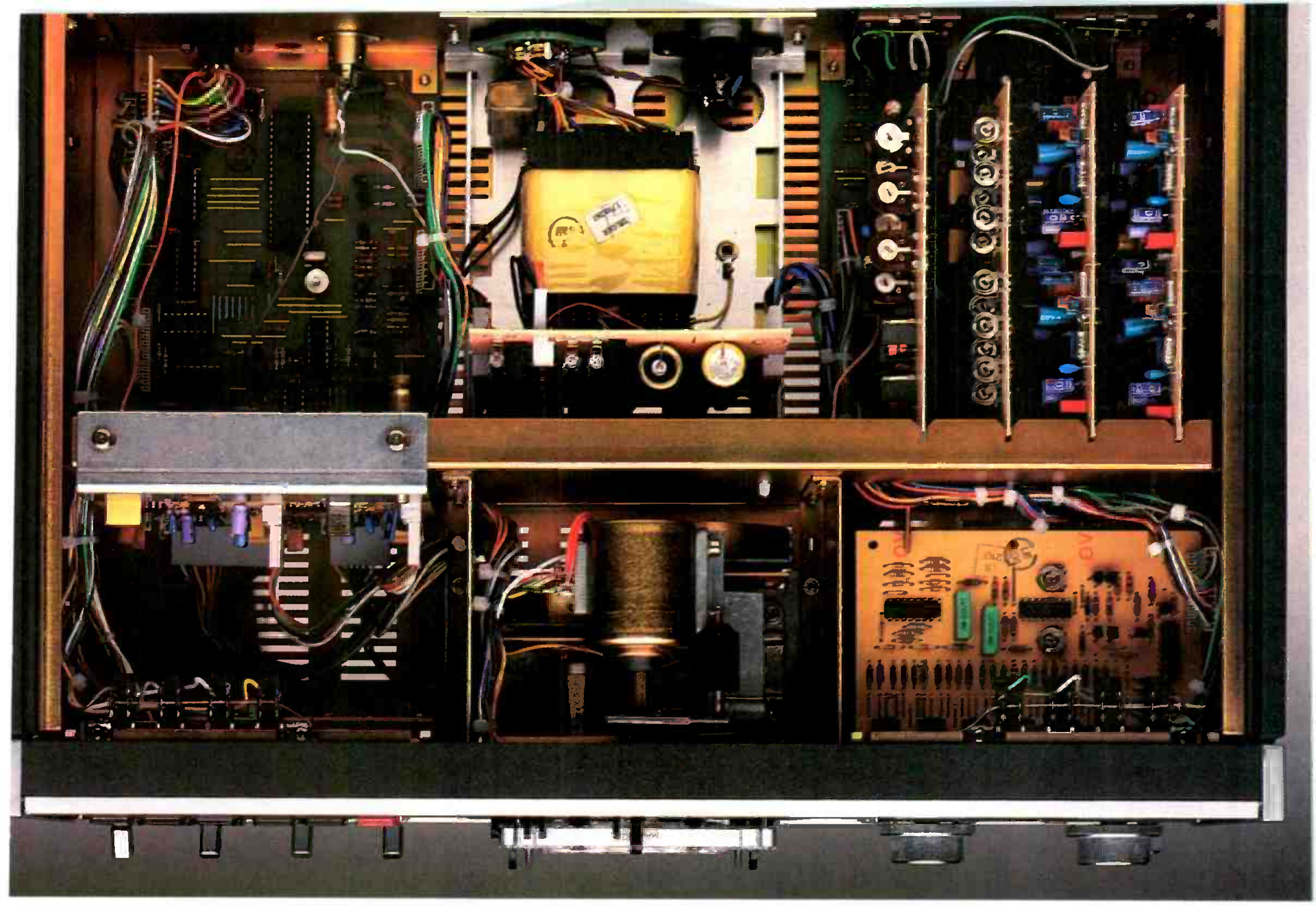

FM MODULATOR
RF BANDPASS FILTER
FM DEMODULATOR
COMPOSITE INPUT SPECTRUM WITHOUT DISTORTION
FILTERED RF SPECTRUM
DEMODULATED OUTPUT SPECTRUM WITH DISTORTION

Figure 21. Bandwidth limited RF path



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The performance follows suit. A B710 MKII not only makes recordings and dubs of unprecedented accuracy, but it also guarantees consistently repeatable results from one B710 to the next. And, thanks to total microprocessor control, production work with this deck is fast and foolproof.

Engineering Fundamentals–The B710 MKII utilizes a die-cast aluminum alloy chassis as a solid base for the four direct-drive motors. (Rubber belts, pulleys, and clutches–which can degrade long-term performance–will not be found here.) The two Hall-effect capstan motors are quartz regulated for exact speed and synchronization; and the two DC spooling motors are microprocessor controlled for constant-speed fast wind, controlled tape tension, and gentle electronic braking.

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In Figures 22 through 27, we view the various spectra generated by the composite baseband at different points within the system. From three baseband input signals, RF spectrum to the demodulator and the demodulated baseband are shown for wide- and narrowband paths. As the bandwidth is reduced, the RF spectrum and demodulated spectrum will change. The change in the RF spectrum is subtle, but the resulting spectrum after demodulation is clearly modified.

Some basic methods of optimizing the RF path include:

- maximizing bandwidth by using a broadband IPA stage;
- using a single tube design or a broadband, completely solid-state design where feasible;
- optimizing both grid and plate circuit of the tuned stage for best possible bandwidth; and
- using a broadband antenna system with a low standing wave ratio on transmission line.

Field adjusting transmitters

Remember that all optimization should be done with the transmitter connected to the normal antenna system rather than to a dummy load.

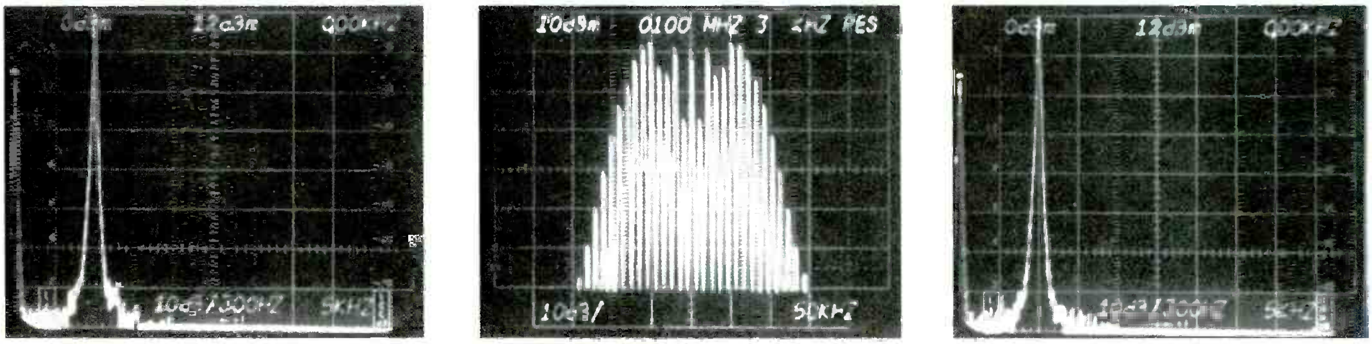
The transmitter is first tuned for normal output power and proper efficiency. A simple method for centering the transmitter passband on the carrier frequency involves adjustment for minimum synchronous AM. Synchronous AM is AM modulation of the carrier caused by frequency modulation of the carrier frequency. If the bandwidth is narrow or skewed, increased amplitude modulation of the carrier will result.

A typical adjustment procedure is to FM modulate 100% at 400Hz and fine tune the transmitter for minimum 400Hz AM modulation as detected by a wideband envelope detector (diode and line probe). It should be possible to minimize synchronous AM while maintaining output and efficiency.

Another more sensitive test is to tune for minimum intermodulation distortion in left only or right only stereo transmissions. Stereo separation will also vary with tuning.

For stations employing a 67kHz SCA, transmitter tuning becomes very critical to minimizing crosstalk into the SCA. Modulate one channel only on the stereo generator to 100% with a 4.5kHz tone. This will place the lower second harmonic (L − R) stereo sideband on top of 67kHz SCA. Activate the SCA at normal injection level without modulation in the SCA. Tune

Continued on page 66

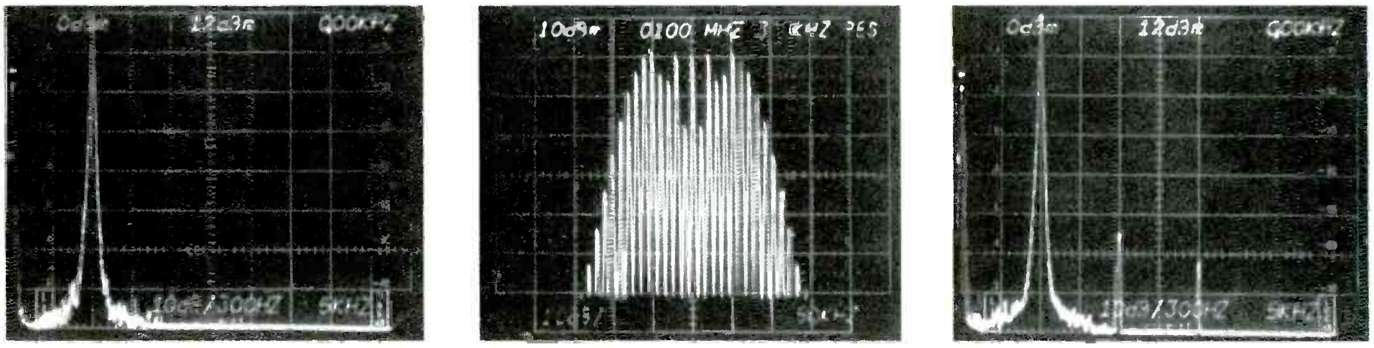


Baseband spectrum to BEI FX-30 modulator

RF spectrum to demodulator

Demodulated baseband spectrum from Boonton model 82AD

Figure 22. Single tone (10kHz) modulation through wideband RF path.

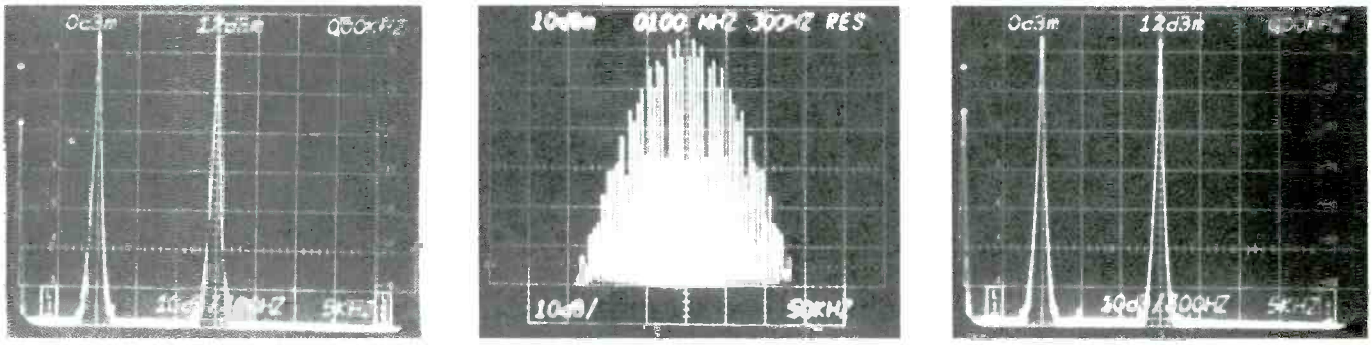


Baseband spectrum to BEI FX-30 modulator

Bandwidth limited RF spectrum to demodulator

Demodulated baseband spectrum from Boonton model 82AD

Figure 23. Single tone (10kHz) modulation through narrowband RF path.



Baseband spectrum to BEI FX-30 modulator

RF spectrum to demodulator

Demodulated baseband spectrum from Boonton model 82AD

Figure 24. Two-tone (10kHz and 25kHz) modulation through wideband RF path.

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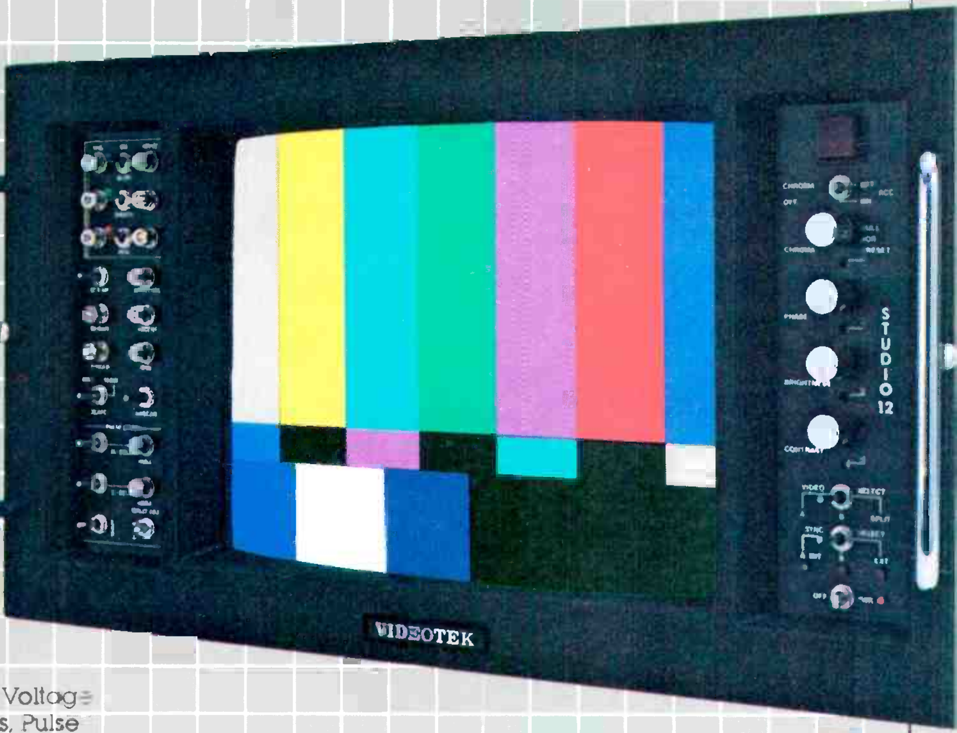

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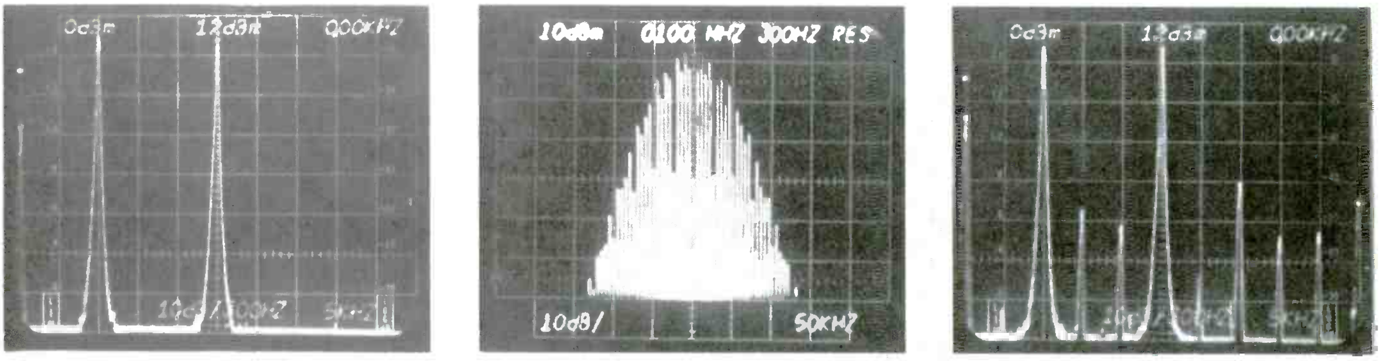

Baseband spectrum to BEI FX-30 modulator

Bandwidth limited RF spectrum to demodulator

Demodulated baseband spectrum from Boonton model 82AD

Figure 25. Two-tone (10kHz and 25kHz) modulation through narrowband RF path.

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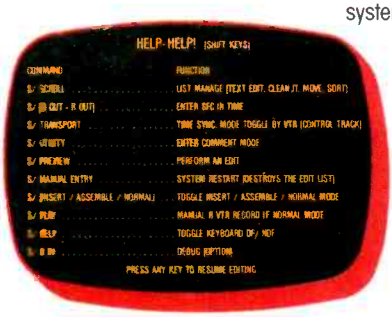

```
HELP-HELP! (SHIFT KEYS)
COMMAND                        FUNCTION
S/ SCROLL ...................  LIST MANAGE (TEXT EDIT, CLEAN IT, MOVE, SORT)
S/ (B OUT - R OUT) ..........  ENTER SFC IN TIME
S/ TRANSPORT ................  TIME SYNC. MODE TOGGLE BY VTR (CONTROL TRACK)
S/ UTILITY ..................  ENTER COMMENT MODE
S/ PREVIEW ..................  PERFORM AN EDIT
S/ MANUAL ENTRY .............  SYSTEM RESTART (DESTROYS THE EDIT LIST)
S/ (INSERT / ASSEMBLE / NORMAL) .. TOGGLE INSERT / ASSEMBLE / NORMAL MODE
S/ PLAY .....................  MANUAL R VTR RECORD IF NORMAL MODE
S/ HELP .....................  TOGGLE KEYBOARD DF/ NDF
S/ [illegible] ..............  DEBUG (OPTION)
PRESS ANY KEY TO RESUME EDITING
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DF/NDF
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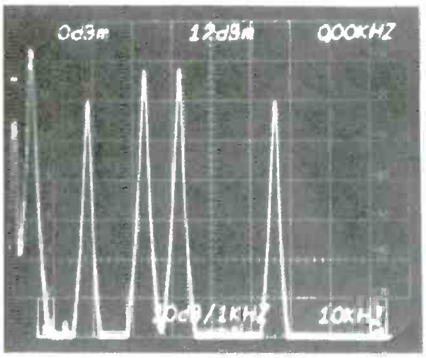
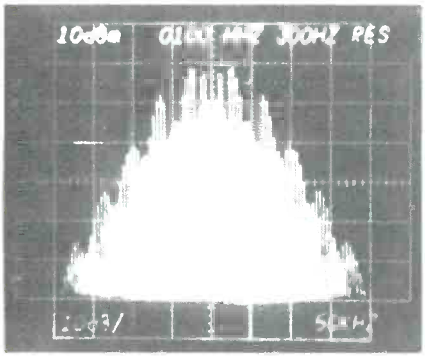
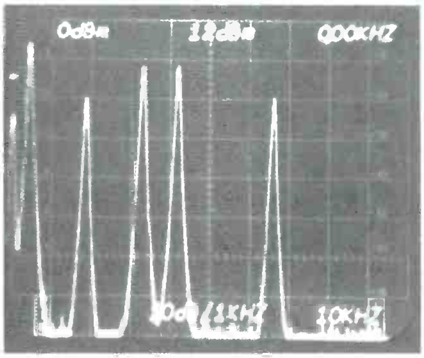


Baseband spectrum to BEI FX-30 modulator



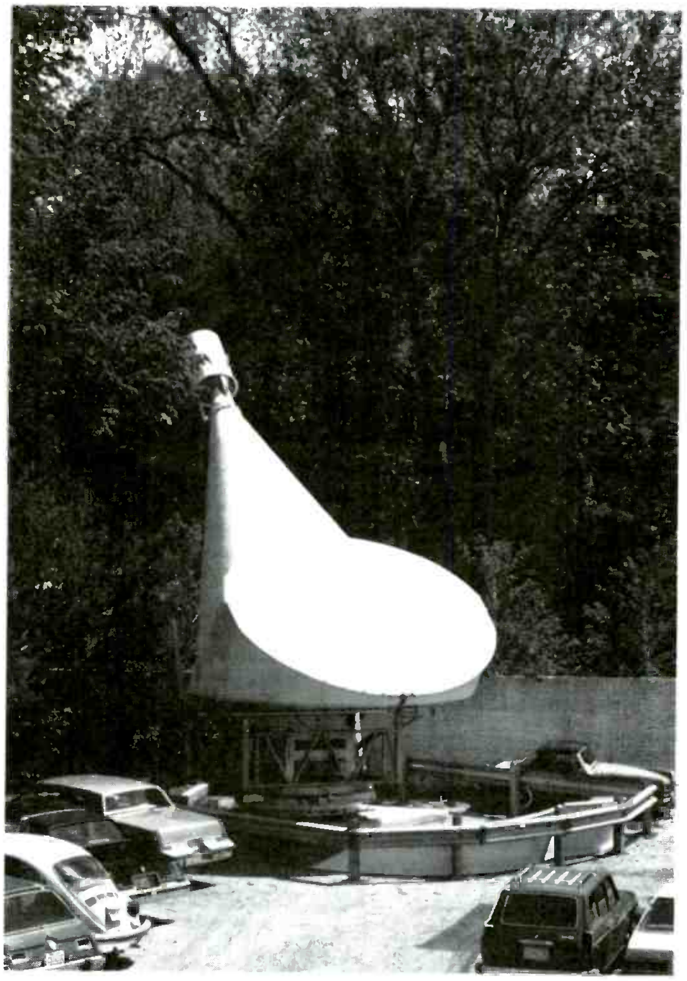
RF spectrum to demodulator



Demodulated baseband spectrum from Boonton model 82AD

Figure 26. Stereo (L or R = 4.5kHz) plus SCA (unmod.) modulation through wideband RF path.

WHEN A DISH WON'T DO



MICRODYNE'S CH-14 AND MAPS II OPERATE SIDE BY SIDE.

Satellite reception is difficult in certain locations. Tall city structures or even mountains often require that parabolic antennas be placed on property elsewhere to avoid interference. Microdyne's field proven, rugged CH-14 conical horn antenna operates where other antennas will not and may be co-located with your station's studio. It is recognized by terrestrial common carrier network operators throughout the world for its superior reception.

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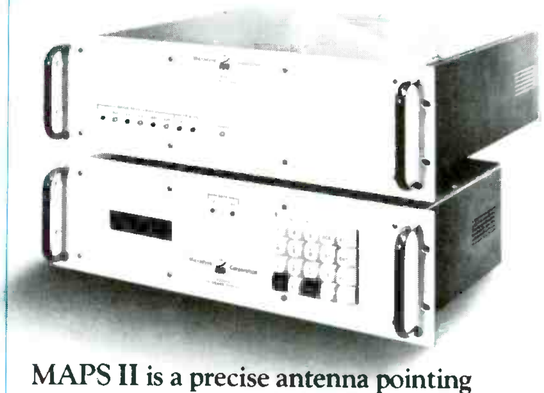

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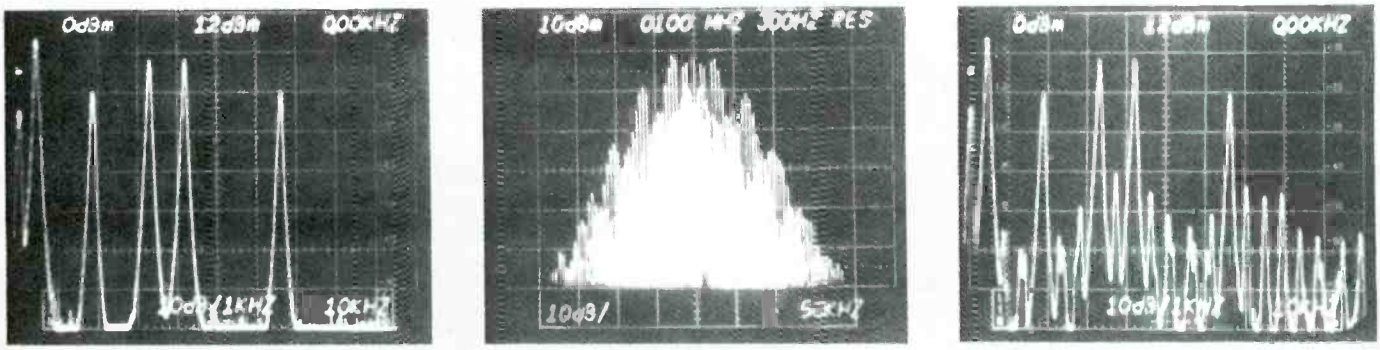

Baseband spectrum to BEI FX-30 modulator

Bandwidth limited RF spectrum to demodulator

Demodulated baseband spectrum from Boonton model 82AD

Figure 27. Stereo (L or R = 4.5kHz) plus SCA (unmod.) modulation through narrowband RF path.

the transmitter for minimum output from the SCA demodulator. This adjustment can also be made by listening to the residual SCA audio while normal stereo programming is being broadcast.

The following are field adjustment techniques in ascending order of sensitivity:

- Tune for minimum synchronous AM noise.
- Tune for minimum IMD in left or right only channel.
- Tune for minimum crosstalk into unmodulated SCA subcarrier.

In any of these tests, the grid tuning is frequently more critical than the plate tuning. This is because the impedance match into the input capacitance of the grid becomes the bandwidth limiting factor. Even though the amplitude response appears flattened when the grid is heavily driven, the phase response has a serious effect on the higher order FM sidebands.

The three areas in the transmission system that affect the composite baseband performance, the composite link to the FM modulator, the FM modulator, and the RF path to the demodulator, have been discussed. Each of these subsystems must be individually optimized before your complete transmission system can give you the best possible performance.

It is hoped that this information will encourage you to investigate your system, and will help you to optimize your composite signal, the key to quality broadcasting.

References

[1] Robert Orban, "An Investigation of Baseband Clipping," presented at the 1980 NRBA Engineering Conference.

[2] Robert Orban, "Degradation of the FM Signal by Baseband Clipping," *BME Magazine,* August 1980, p. 51.

[3] Geoffrey Mendenhall, "Designing a New FM Exciter," *Broadcast Communications,* Vol. 3, No. 2, June 1980, pp. 30-36.

[4] Frederick Terman, *Electronic and Radio Engineering,* McGraw-Hill Book Company, Copyright 1955, pp. 586-600.

[5] *Reference Data for Radio Engineers,* Howard W. Sams & Co. Inc., Copyright 1968, pp. 44-38 and pp. 45-20 through 45-22.

For maintenance technicians, no practice is perfect!

Too much routine studio maintenance is enough to turn off any good technician. They'd prefer to spend their time on more pressing problems, rather than just practicing their skills on routine chores. And that's what makes the AVL Digital Routing Switcher perfect for busy maintenance departments. It's routine-maintenance free. No practice is necessary!

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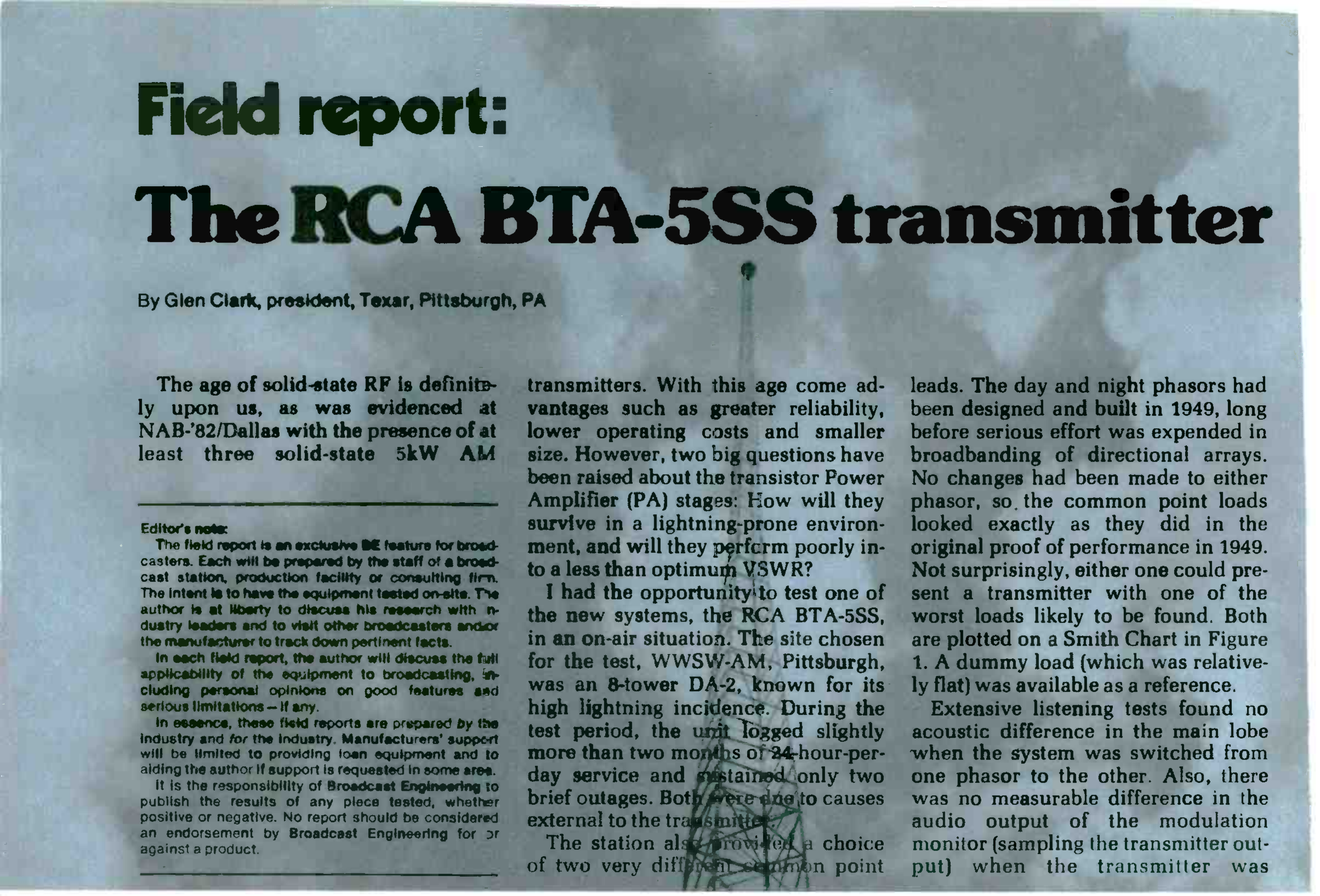

Field report:

The RCA BTA-5SS transmitter

By Glen Clark, president, Texar, Pittsburgh, PA

The age of solid-state RF is definitely upon us, as was evidenced at NAB-'82/Dallas with the presence of at least three solid-state 5kW AM transmitters. With this age come advantages such as greater reliability, lower operating costs and smaller size. However, two big questions have been raised about the transistor Power Amplifier (PA) stages: How will they survive in a lightning-prone environment, and will they perform poorly into a less than optimum VSWR?

Editor's note:

The field report is an exclusive BE feature for broadcasters. Each will be prepared by the staff of a broadcast station, production facility or consulting firm. The intent is to have the equipment tested on-site. The author is at liberty to discuss his research with industry leaders and to visit other broadcasters and/or the manufacturer to track down pertinent facts.

In each field report, the author will discuss the full applicability of the equipment to broadcasting, including personal opinions on good features and serious limitations – if any.

In essence, these field reports are prepared *by* the industry and *for* the industry. Manufacturers' support will be limited to providing loan equipment and to aiding the author if support is requested in some area.

It is the responsibility of **Broadcast Engineering** to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement by **Broadcast Engineering** for or against a product.

I had the opportunity to test one of the new systems, the RCA BTA-5SS, in an on-air situation. The site chosen for the test, WWSW-AM, Pittsburgh, was an 8-tower DA-2, known for its high lightning incidence. During the test period, the unit logged slightly more than two months of 24-hour-per-day service and sustained only two brief outages. Both were due to causes external to the transmitter.

The station also provided a choice of two very different common point leads. The day and night phasors had been designed and built in 1949, long before serious effort was expended in broadbanding of directional arrays. No changes had been made to either phasor, so the common point loads looked exactly as they did in the original proof of performance in 1949. Not surprisingly, either one could present a transmitter with one of the worst loads likely to be found. Both are plotted on a Smith Chart in Figure 1. A dummy load (which was relatively flat) was available as a reference.

Extensive listening tests found no acoustic difference in the main lobe when the system was switched from one phasor to the other. Also, there was no measurable difference in the audio output of the modulation monitor (sampling the transmitter output) when the transmitter was

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The SPECTRA SOUND Model 1500 Twenty-Seven Band Graphic Equalizer is the result of nearly two decades of engineering excellence. The Model 1500 represents a significant improvement over current equalizer technology.

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The Model 1500 has the lowest distortion of any equalizer available. The THD and the IM distortion of the Model 1500 are below .0018%, test equipment residual, 20Hz to 20kHz, +18dBv.

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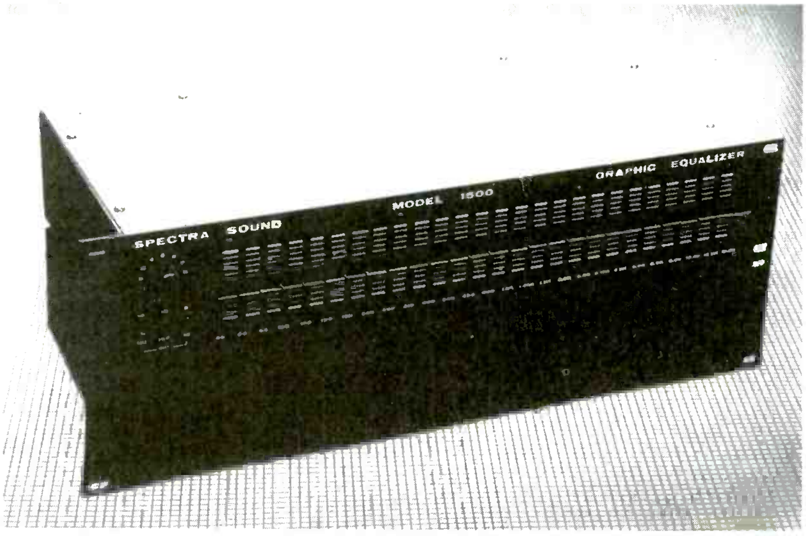
The Model 1500 is the quietest equalizer available. The signal-to-noise-ratio is 104dB below +4dBv, unweighted, 20Hz to 20 kHz.



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Camera location 3 behind home plate is no place to tear down a camera. Especially if the director wants to punch it up on air to catch the next pitch. That's just one reason why the rock-steady, works-everytime HK-357A is an outstanding choice for production in the field.

Beyond its reputation for legendary Ikegami reliability, the HK-357A has a lot more to recommend it as the ideal field camera. For example, its crisp, high resolution picture, signal-to-noise ratio of better than 53 dB, and superb colorimetry.

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switched from the dummy load to either phasor and back again. In short, the PA did not seem strongly affected by changing loads.

Redundancy for reliability

One of the inherent advantages of a solid-state transmitter is higher reliability. Like an airplane with only one motor, a transmitter with only one output device, be it tube or transistor, becomes inoperative if that device fails. The maximum dissipation currently available in solid-state devices is a few hundred watts. As a result, any broadcast transmitter in the kilowatt power range will have a number of transistors in the output stage. The RCA system uses 168.

The stages were designed in a way so as to remove a defective device from the circuit, allowing the rest to continue operating. If a small number of devices fail, the transmitter will continue to operate at the rated power. If a larger number of devices fail, it will operate at reduced power, but operate, none the less.

The BTA-5SS has six PA modules with 28 transistors in each. Each of the four modulator modules uses 24 transistors. The modules mount on a set of plugs and may be replaced with a spare in seconds. If a major failure

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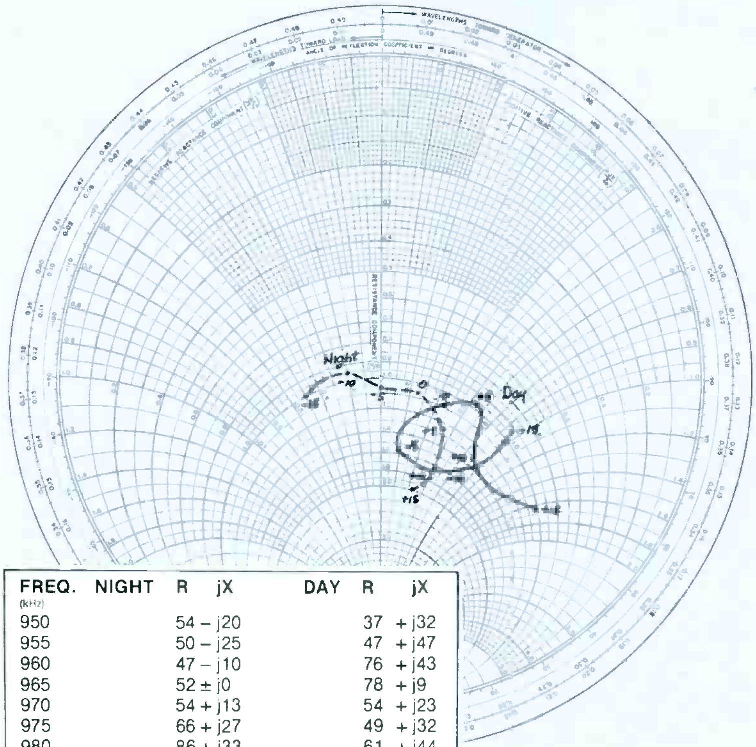

FREQ. (kHz)	NIGHT R	jX	DAY R	jX
950	54	– j20	37	+ j32
955	50	– j25	47	+ j47
960	47	– j10	76	+ j43
965	52	± j0	78	+ j9
970	54	+ j13	54	+ j23
975	66	+ j27	49	+ j32
980	86	+ j33	61	+ j44
985	100	+ j23	53	+ j82
990	105	+ j4	46	+ j109

Figure 1. Smith Chart illustration of day and night phasor common point load impedances at 970kHz.

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- Integral time code generator, including jam sync. Genlock option. Switchable frame rate (30, 29.97, 25, 24 FPS).
- Time code readers. −30 to +10 dBm SMPTE/EBU/DROP. Even okay with discontinuous/edited code.
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- Computer boards are exclusively C-MOS and TTL MSI, and contain over 22 LSI integrated circuits.
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- Software intensive compared to other synchronizers on the market.
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- 10 L.E.D. status indicators.
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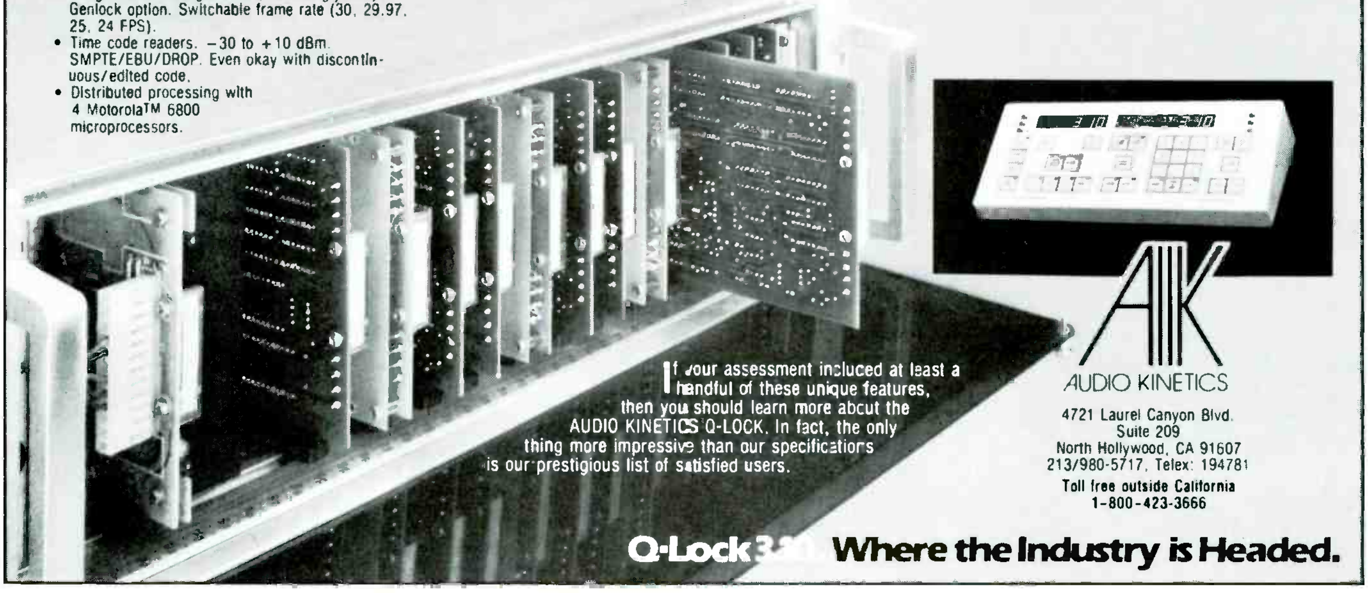

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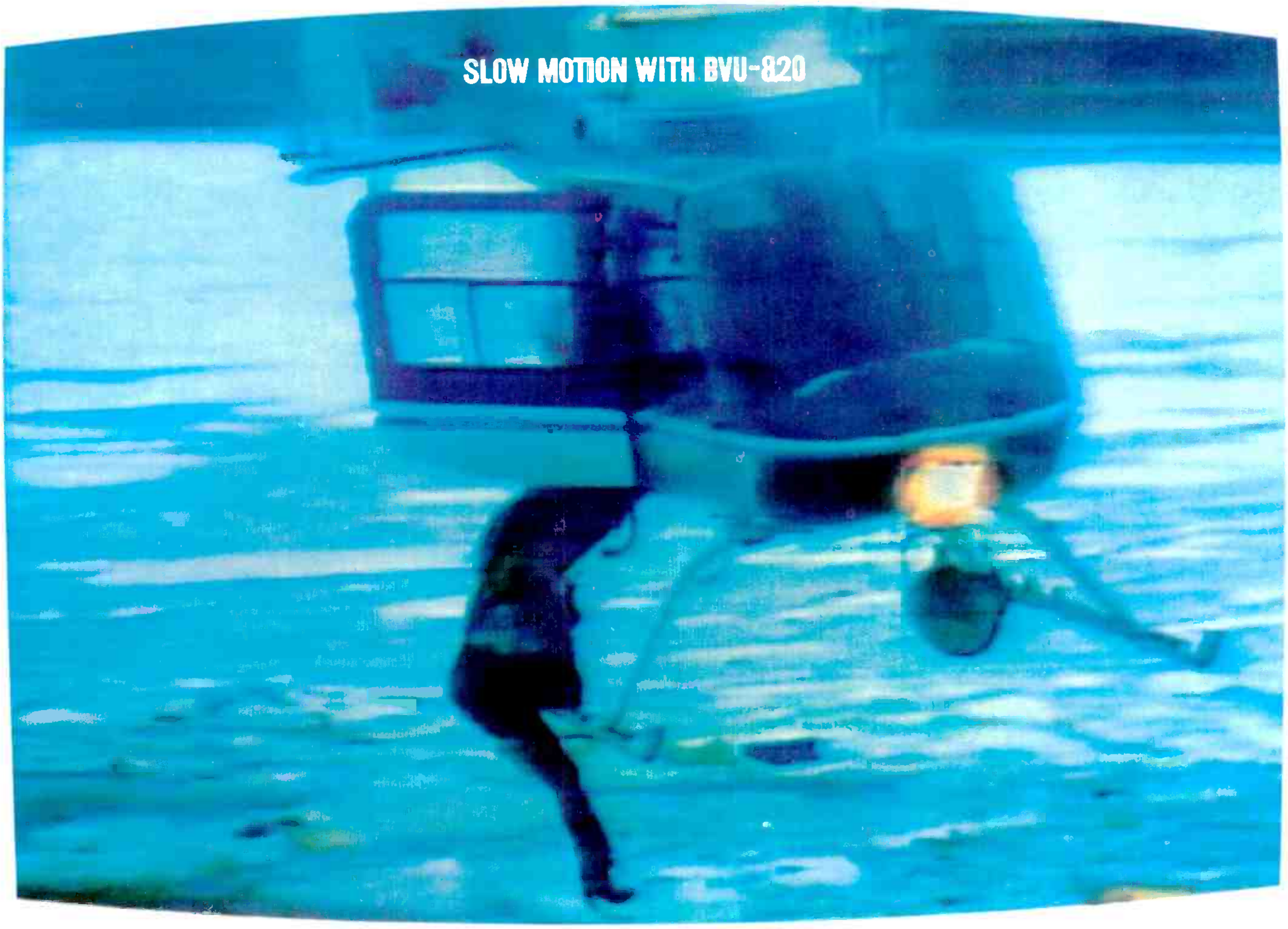

Sony, the inventor of the U-matic® format, as well as every link in the chain, has evolutionized U-matic again.

Now, for the first time ever, you can make instant broadcast-quality edits of those dramatic events which call for freeze frame, slow motion, fast forward or reverse, without transferring to 1″.

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TWO NEW WORDS IN ¾″ VTR'S: DYNAMIC TRACKING.®

At the heart of the new, fully integrated, plug-compatible Sony editing system is the BVU-820 videocassette recorder.

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But there's one brilliant addition—Dynamic Tracking. Which means U-matic users now have the ability to broadcast special effects—something which, until now, has only been associated with more expensive reel-to-reel broadcast VTR's.

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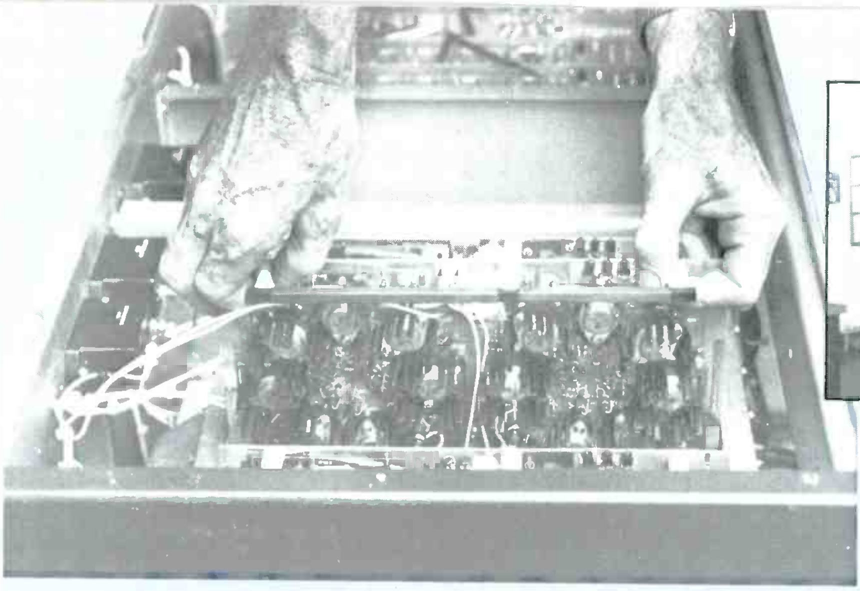
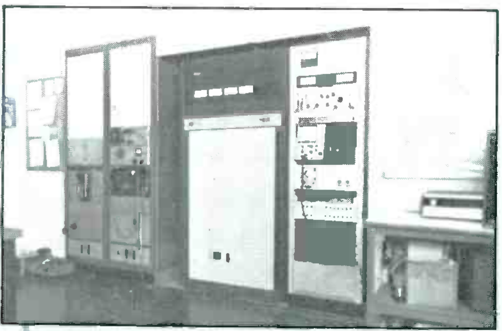


One of the six plug-in PA trays shown removed from its sockets. In the background, the four modulator trays are visible.



The BTA-5SS in place at WWSW-AM. Front panel meters provide PA volts, PA amps, RF amps and a multimeter function.

Continued from page 70

occurs, this design lets the engine get the transmitter back on the air at full power. He can then troubleshoot the module at his leisure, or return it to the factory for repair.

A number of authors have predicted in the past that someday it would be possible to repair a transmitter by *module swapping*, the same way we have repaired cart machines for years. That day is here. It will be interesting to see what the qualifications of the typical transmitter engineer will be in 15 years, as more and more transmitters of solid-state design reach the field. This is especially relevant in view of the abolition of the FCC First Class Radiotelephone License.

Operating economy

Measured power consumption of the BTA-5SS is 11.4kVA for 100% sine wave modulation. Rated power consumption for a competitive tube-type transmitter of excellent design is 13kVA at 95% modulation. Assuming a 24-hour broadcast day, the broadcaster who pays 10 cents per kilowatt hour will realize a $1400 annual saving in power consumption, compared to the cost of operating the comparable tube-type system. (The test station noted an increase in heating fuel oil consumption during the November test period.) Broadcasters who have a higher cost for electricity will save more.

These cost figures are not surprising, when one considers that the solid-state transmitter operates output devices in high efficiency switching mode; does not have a tube filament to

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ALLEN AVIONICS Video & Pulse Delay Lines replace 75 ohm coaxial cable, provide a more suitable method of achieving precise short delays. The units reduce size, weight, installation costs, save time & effort in making delay changes.

Part No.	Delay Range (Nano-Sec.)	Delay Steps (Nano-Sec.)	Method of Variation	Maximum Insertion Loss @ 100 KHz (db)	Amplitude Flatness At Any Delay Setting 100 KHz to 5.5 MHz (db)	Max. Rise Time (Nano-Sec.)	Package Size (Inches)
VAR005	3-7	Continuous	Trimmer	.20	.2 Max.	N.A.	3 5/8 x 1 1/2 x 1 1/4
VAR011	0-11	Continuous	Trimmer & Toggle	.20	.25	N.A.	4 3/8 x 2 3/8 x 1 1/16
VP0010	0-10.5	.5	Toggle	.15	.2	3	4 3/8 x 2 3/8 x 1 1/16
VP0127	0-127	1.0	Toggle	.15	.3	14	4 3/8 x 2 3/8 x 1 1/16
VP0255	0-255	1.0	Toggle	.15	.3	16	4 3/8 x 2 3/8 x 1 1/16
VP0317	0-317.5	2.5	Toggle	.15	.3	20	4 3/8 x 2 3/8 x 1 1/16
VP0635	0-635	5.0	Toggle	* .50	.4	25	4 11/16 x 3 11/16 x 2 1/16
VP1100	0-1100	10.0	Rotary	1.25	.4	30	4 11/16 x 3 11/16 x 2 1/16
VP1270	0-1270	10.0	Toggle	*3.00	.4	30	4 11/16 x 3 11/16 2 1/16
VP2075	0-2075	25.0	Toggle	*3.00	.5	40	7 3/8 x 4 11/16 x 2 3/16
VS0315	0-315	5.0	Strap	.25	.4	28	4 x 2 x 1 1/4
VS0635	0-635	5.0	Strap	.60	.5	33	5 x 2 x 1 1/4
VS1275	0-1275	5.0	Strap	1.25	.5	33	5 x 3 x 1 1/4
VS2075	0-2075	25.0	Strap	2.50	.5	40	6 1/2 x 3 1/2 x 2
RACK MOUNTABLE UNITS							
VRM0255	0-255	1.0	Slide Switch	.40	.4 Max.	20	1 1/8 x 4 1/8 x 4
VRM0637	0-637.5	2.5	Slide Switch	*1.00	.4	28	1 1/8 x 4 1/8 x 6
VRM1275	0-1275	5.0	Slide Switch	*3.00	.4	33	1 1/8 x 4 1/8 x 9
VRM2270	0-2270	10.0	Slide Switch	*3.00	.5	40	1 1/8 x 4 1/8 x 9
VRS0317	0-317.5	2.5	Strap	.40	.5	26	1 1/8 x 4 1/8 x 4
VRS0635	0-635	5.0	Strap	.75	.5	35	1 1/8 x 4 1/8 x 6
VRS1270	0-1270	10.0	Strap	1.50	.5	37	1 1/8 x 4 1/8 x 9
VRS2260	0-2260	20.0	Strap	3.00	.5	40	1 1/8 x 4 1/8 x 9

*±.2db variation at any delay setting.

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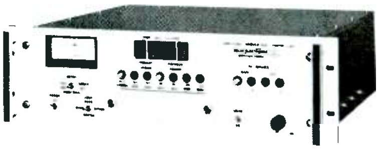
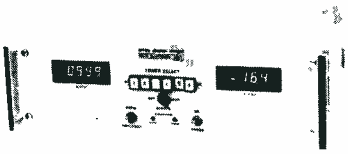
DELTA BROADCAST PRODUCTS

AMC-1/FMC-1



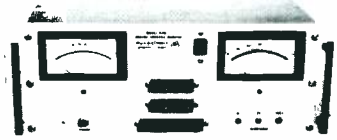
The **Modulation Controllers** are the only modulation controlling systems that provide a completely closed loop around the transmitter. The sampling of actual modulation levels after the PA output network assures precise adjustment for optimum modulation levels. The AMC-1/FMC-1 also keep a digital count of positive and negative overmodulation bursts for both present and previous one minute periods.

DAM-1



The **Digital Antenna Monitor** couples pushbutton ease of operation with digital accuracy. The DAM-1 will accept RF samples from up to 12 towers (with an auxiliary panel) and features ± 1° phase and ± 2% current ratio accuracies. Remote panels and other accessories are available.

AAM-1



The **Analog Antenna Monitor** gives stable phase and ratio readings even in high RF fields. Separate phase and ratio mirrored-scale meters assure accurate meter indications.

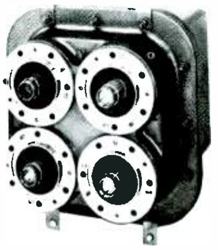
RCS-1V

The **RCS-1V Remote Control System** combines microprocessor technology with simplified operation. Features include direct interface boards for antenna monitors, patented remote modulation bargraph, automatic logging, and synthesized speech telephone interface. The modular design allows the customer to plug in additional input or control boards to expand remote control capabilities even after the system is operating in the field.

APC-1

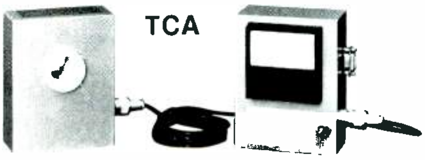
The **Automatic Power Controller** is your insurance against citations for over- and under-power operation. The APC-1 continuously monitors the transmitter output power, and makes automatic power adjustments with the transmitter loading control. This assures proper power adjustment at all times.

6730-E
6740-B



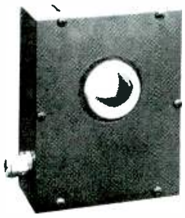
Designed to switch two transmitters from antenna to dummy load, the 6730E interfaces with 1 5/8 inch coaxial cable. For 3 1/8" lines, the 6740-B transfer switch is used. Either manually or remote controlled, the **Transfer Switch** is fully interlocked and can be wired to existing equipment to prevent "hot" switching.

TCA



State of the art antenna current metering has arrived in the **TCA Ammeter Systems.** Accurate, Modulation-free, temperature stable current indications are found in the TCA. Models include single and dual scale meters.

TCT



Delta's **Toroidal Current Transformers** provide accurate sampling current and phase values without the problems associated with sampling loops. Three output voltage ranges are available, as well as high voltage models for high-power facilities.

OIB-1

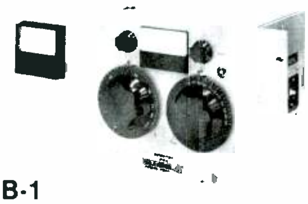
OIB-3

The **Operating Impedance Bridge** measures the impedance of networks, radiators, and the like while they operate under full power. VSWR as well as complex impedances of up to 400 ± j300 ohms can be measured.

The **OIB-3 Operating Impedance Bridge** provides extended resistance and reactance ranges, measuring up to 1000 ± j900 ohms. The bridge has a built-in carrying case and RF amplifier for improved nulling.

RG-3

The **Receiver/Generator** combines a two-watt RF output and a correlation detector circuit that virtually eliminates interference problems. The RG-3 can be used in conjunction with any conventional impedance bridge including the OIB series.



CPB-1

The **Common Point Impedance Bridge** is designed for permanent installation; and allows continuous monitoring of the common point, thus facilitating network adjustment. This model can be provided with one of Delta's TCA ammeters mounted in the front panel.

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consume power; and does not require large blowers to remove gross amounts of excess heat.

When the first 1kW solid-state transmitter was released several years ago, the question arose: When will solid-state come to the 5kW level? Now that 5kW is here, the next logical question is being asked: When will we see a solid-state 50kW transmitter?*

I think that the day is much closer than most people believe. Substantial improvements have been made in the last two years in the field of power FETs, making the technology simpler. But the real reason is economic. It is safe to say that the amount of power saved by use of a solid-state rather than a tube-type transmitter is proportional to the power level.

The 5kW comparison netted an annual power saving of $1400, so a 50kW station should realize 10 times that saving, or $14,000. Similarly, the 1kW station will save $280 for the same period.

A WWSW-AM staff member reads the individually metered parameters on the Westinghouse transmitter-of-license.

By contrast, transmitter cost is not proportional to power level. If one assumes the cost of a 1kW transmitter to be $14,000, the price of a 5kW system to be $35,000, and the cost of a 50kW transmitter to be $140,000, it is apparent that the 5kW system costs only 2½ times as much as the 1kW. Similarly, the 50kW is only four times as expensive as the 5kW. As a result, the yearly savings becomes a larger percentage of the transmitter's purchase price as power level increases. The 1kW station has saved 2%, the 5kW has saved 4% and the 50kW station has saved 10% of the cost of a new transmitter in one year. In many major cities with cost-per-kilowatt rates nearly double that assumed in the model, annual savings could be closer to 20% the cost of the transmitter.

As operating costs become a larger percentage of the purchase price of an item, older equipment can be retired sooner on economic grounds alone. A possible result is a strong industry demand for a reliable solid-state 50kW transmitter. Such things make manufacturers' accountants smile... and commit larger sums of money to research and development. I predict the release of a solid-state 50kW transmitter for broadcast use at or before the 1984 NAB Convention.

As a last economic comparison, solid-state devices do not normally age and require periodic replacement, as tubes do. Excluding a catastrophic failure, a transistor with 10,000 hours of service is just as good as a new one.

Reduced maintenance

The BTA-5SS has no tuning controls. Once the coil taps are set at installation, there are no adjustments to make, other than remote control sample voltage calibrations. I expect other solid-state designs are similar.

Weekly transmitter cleaning is also likely to be reduced to monthly intervals or longer. Dirt builds up in transmitters primarily because of the large volumes of air that must be moved through the transmitter to remove excess heat. Also, the high potential of the B+ supply acts as an efficient electrostatic air cleaner, drawing from the air and attaching it to the charged components.

Because cooling of the BTA-5SS is done with several small muffin fans, air movement is minimal. Not only is the volume of air moved less, but also

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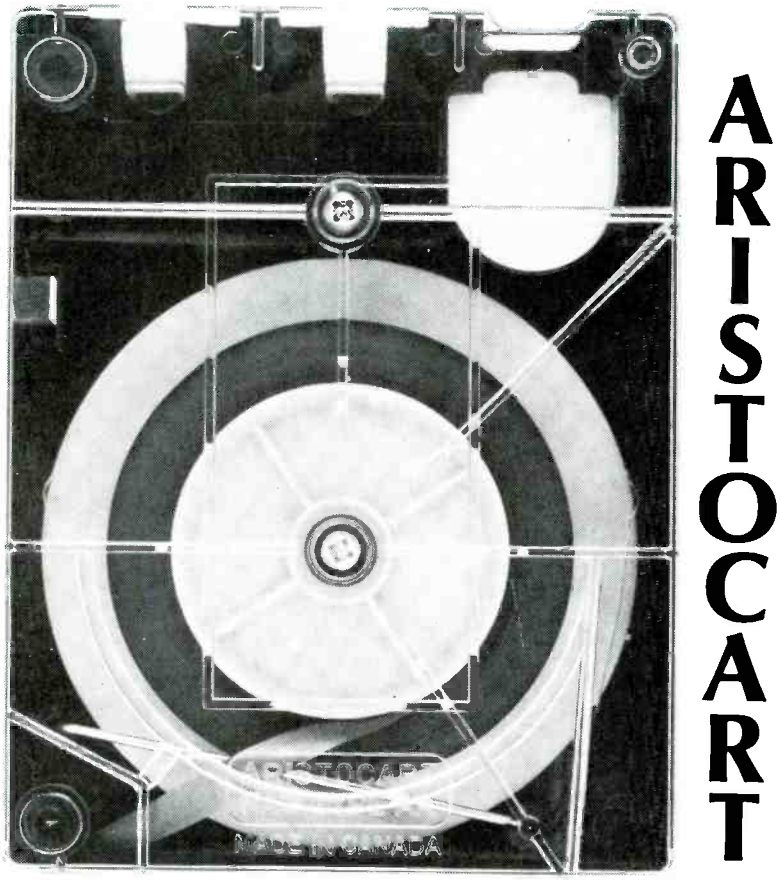
***Editor's note:** We understand that such a system exists, but it is government classified.



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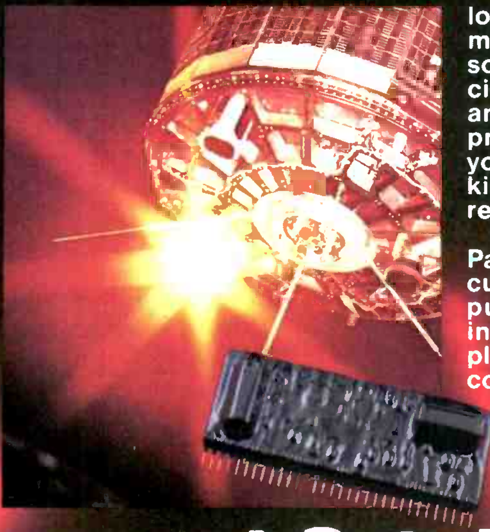

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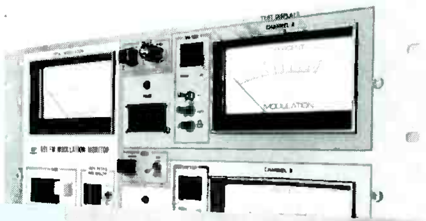
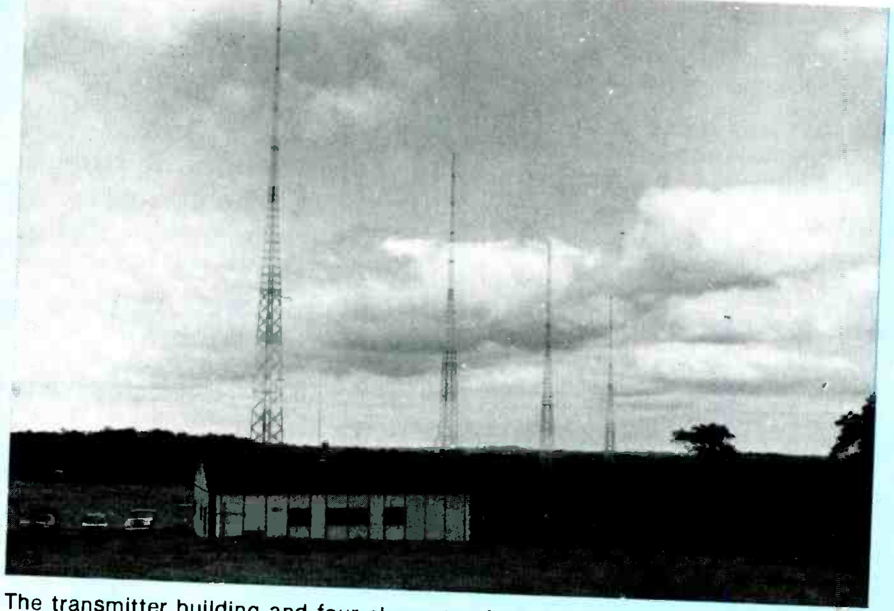


Manufacturer's specifications for BTA-5SS

RF generator	Synthesized
Frequency range	525-1605kHz
Frequency stability	± 3.5Hz
Carrier shift	Less than 1.5%, 100% modulation
Power output	Nominal 5kW
Impedance	50Ω, unbalanced
Output connector size	1⅝-inch EIA
Modulation type	Pulse linear



The transmitter building and four elements of the 6-tower array required to attain what is reported to be one of the most difficult radiation patterns in the United States.

power system. By contrast, the solid-state transmitter has one, possibly two, separate supplies with potentials exceeding 100V. The highest potential will be a few hundred volts. It is not unthinkable that transmitter maintenance of the future could be done by one careful engineer, rather than by two.

Final thoughts

Since the beginning of broadcasting, the transmitter has required a substantial part of the engineering department's time and has been a major force in determining the way in which engineering departments have evolved. Separate though they are, most engineering departments have tended to evolve into similar organizations, mainly because they have similar duties.

Solid-state transmitters offer many economic advantages that will move them into the field faster than if they were just another series of new transmitters. These same transmitters, however, require less and different maintenance than the transmitters that we have grown accustomed to in the last six decades. As this once pivotal point of the engineering department has evolved into something quite different than what it has been in the past, so also is it likely that the engineering department of the future will evolve into something different than what it is now.

Editor's note:

Before and during the time that arrangements were being finalized for this report, the author was chief engineer of WWSW-AM, Pittsburgh. He subsequently left that position to form Texar. However, he was allowed access to the station's facilities for testing regarding this article. The transmitter system was installed by RCA, with FCC permission, for in-field testing and evaluation.

These tests and the author's research proved valuable to RCA. Following the tests, the subject transmitter was returned to RCA's facilities in Meadowlands, PA. At that time, the author; Bill Rhodes, **BE** editorial director; and Fred Huffman, RCA's manager of radio sales development, met to observe and perform more in-house tests. As a result, the author made several suggestions in design and specifications that he thought would be beneficial to broadcasters.

For more information on the BTA-5SS AM 5kW transmitter, contact: RCA Commercial Communications Division, Front and Cooper Streets, Camden, NJ 08102.

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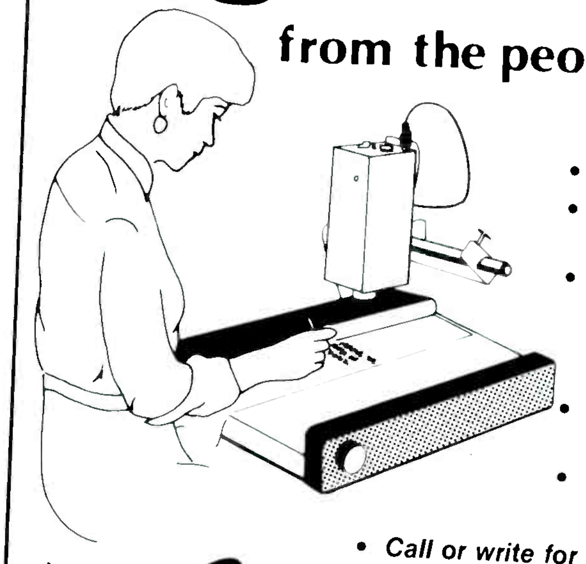

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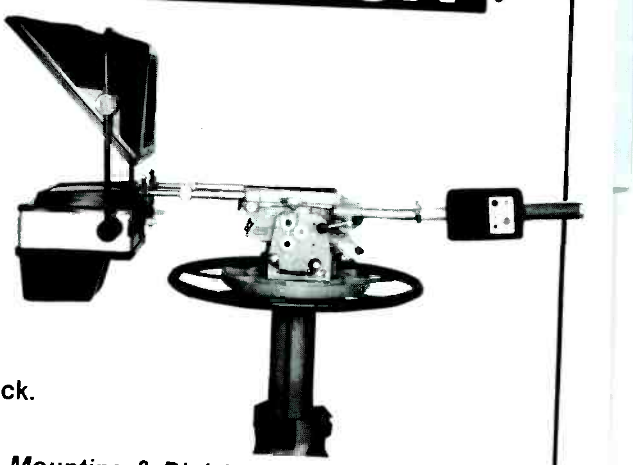

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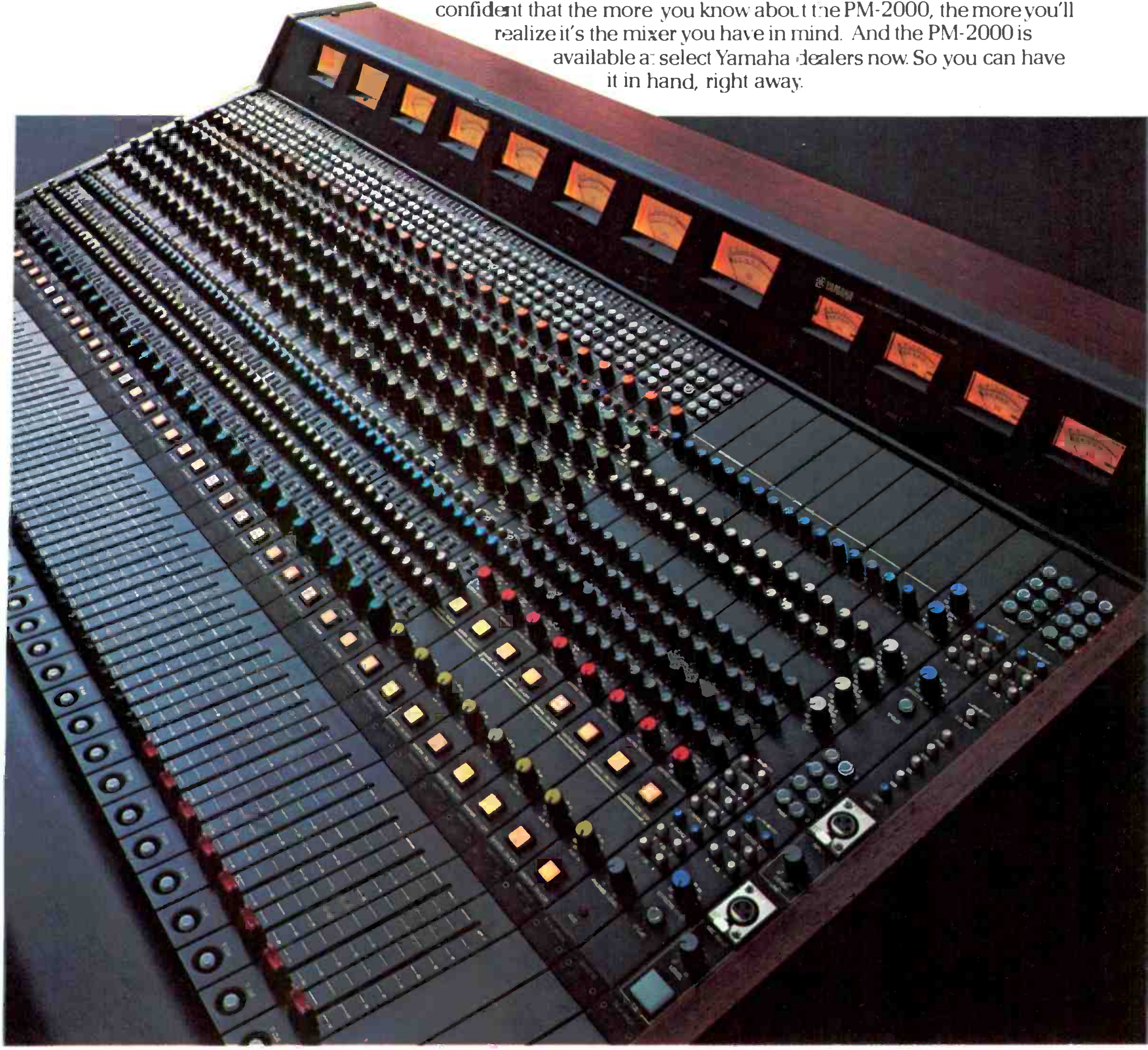

YAMAHA

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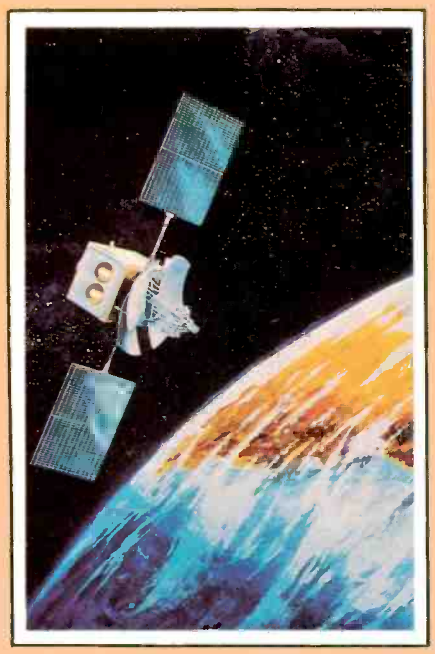
Satellites big in European television

By Michael J. Adams, British correspondent, United Kingdom

Developments concerning satellites are the focus of attention in London, where an announcement has recently been made of Europe's first experimental satellite TV service. A more immediate development, however, is the latest move in the breakfast TV area.

The governors of the BBC have sanctioned a breakfast-time service, possibly to be initiated on-air before Christmas. This will be well before TV-AM, the commercial service scheduled to go live in May 1983. There is some concern within the commercial company, and Peter Jay, chairman, is pressing the Independent Broadcasting Authority for an earlier launch date.

The BBC has budgeted £5 million a year for its proposed two hours of news and interviews, to originate in its London Lime Grove studios. Using the European Space Agency's Orbital Test Satellite (OTS), the first phase of the satellite tests consisted of a full 5-hour schedule on each day of the last week of May 1982. The service was transmitted from the Independent Broadcasting Authority's mobile dish transmitter. The signal, scrambled to prevent unauthorized use, was received by closed circuit only in Britain, Algeria, Austria, Belgium, West Germany, the Republic of Ireland, Italy, Malta, the Netherlands, Portugal, Spain, Switzerland and Tunisia, all members of the European Broadcasting Union.


Courtesy of RCA Americom

The initial week of transmission was designed to test the feasibility of a full-scale European service. Four 1-week trials will follow, coordinated by other national broadcasting services. Schedules will include a wide selection of material provided by participating countries. The objectives of the experiments are to demonstrate and test different schedule patterns for a pan-European TV service; to

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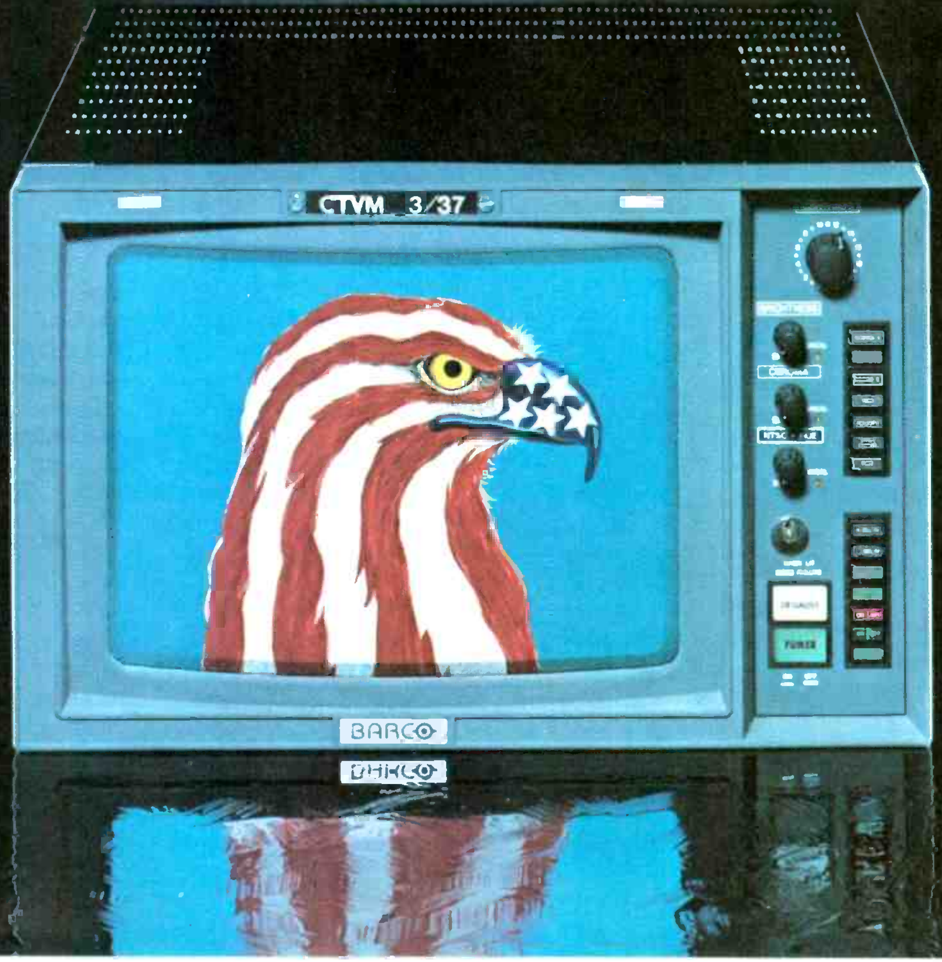

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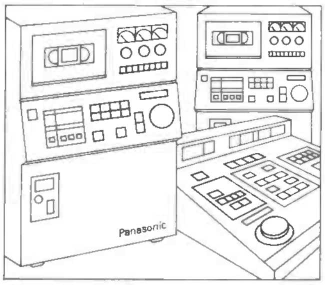
Recam: The System

The Recam system consists of the AU-100 portable VCR, the AK-100 3-tube prism optics camera and the AU-300 playback editing system. Together they add a new dimension to ENG and EFP.



Here's how: Unlike conventional recording systems, Recam records frequency modulated luminance signals on a single-slant track. At the same time, I and Q signals are recorded on another parallel track. By assigning separate FM frequencies to the I and Q signals, color noise, streaking and other two-phase color problems are eliminated because only the final product is NTSC encoded.

The AU-100 has a direct-drive motor for precise tape movement and a capstan motor designed for reduced gyro effect. And for accurate assembly edits after every shot, the AU-100 backspaces 30 frames every time the VTR trigger is released.

The AU-100 also records audio on two longitudinal tracks and time code on a third track. The AU-100 supplies a constant readout of vital operating conditions including drum and capstan lock status, slack tape detection, dew warning detection and a lot more.

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The AK-100 camera gives you the choice of ⅔" diode-gun Plumbicon® tubes or ⅔" Saticon® tubes. So you can shoot under a wide variety of lighting conditions without worrying about lag, blooming or burn-in.

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FUSE
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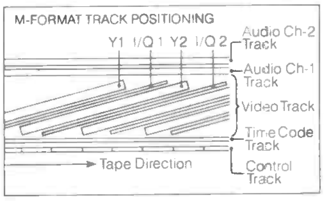
Resolution with the Plumbicon configuration is 600 lines with a S/N ratio of 59dB, while the Saticon version produces 550 lines and a S/N ratio of 58dB. For added dynamic range and reduced comet tailing, the AK-100 includes feedback beam control. Dynamic focus and corner registration compensation circuitry add to picture quality as do horizontal and 2-line vertical contouring. There's also switchable black stretch and knee circuits for detail retention in dark or bright areas of the image. An eight-bit A/D and D/A converter with memory automatically adjusts white and black balance.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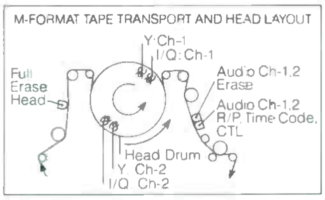
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assess possible audience reaction to such a service and its impact on existing national services; to assess the costs and effectiveness of multichannel audio and teletext subtitling in different languages; to seek new ways of making programs understandable to a multilingual audience; to access the nature and cost of the central services, including news and information services required for an operational European service; to identify and resolve the technical, legal and financial problems that an operational service would present; and to draw attention to the interest of European public service broadcasters in cooperation in the field of direct broadcast satellite.

The experiments, coordinated by an international operations group headed by Neville Clarke, the Independent Broadcasting Authority's (IBA) senior TV program officer, will also employ the latest techniques in digital sound. Up to four different language channels will be possible.

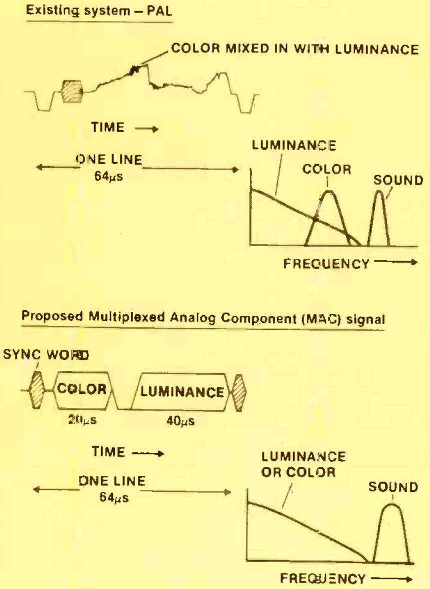

Figure 1. A comparison between the existing PAL system and the Independent Broadcasting Authority's proposed MAC system.

Enhanced signal format

A recent report from the IBA discussed an enhanced TV signal format for satellite broadcasting. This format, known as MAC (multiplexed analog component signals), tries to provide a quality equal to, perhaps better than, that available from terrestrial transmissions on existing receivers. It should be possible to display these pictures on existing receivers with the minimum of additional complexity in the satellite converter unit.

The MAC system retains the 625-line format. However, instead of 50 interlaced fields of 312 half lines, it

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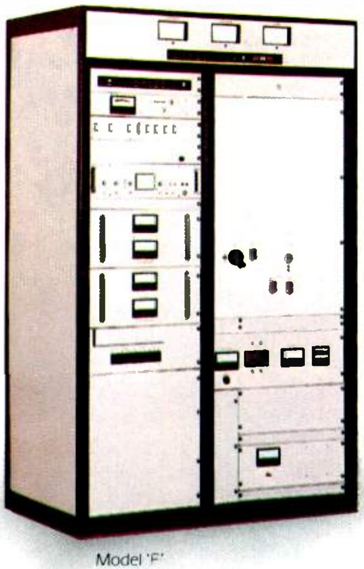
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will use 50 picture scans per second, each containing 625 lines. The new system will separate the color and luminance information into 20μs and 40μs blocks within the 64μs line duration. A time compression process effectively allows the information for an interlaced pair of lines to be transmitted during a 64μs period. Processing prior to transmission discards alternate lines to maintain compatibility with the system now in use. This processing will enable extra circuitry in a high definition receiver to recreate the original 625 lines of each picture scan, doubling the amount of displayed picture detail

A digital transcoder

BBC and IBA engineers are concerned with international standards, and the BBC has produced its first digital SECAM to PAL transcoder. It uses digital sampling standards set out in CCIR Recommendation A11, which suggests a sampling frequency of 13.5MHz for luminance and 6.75MHz for each of the two color difference signals. The BBC's engineers played a minor part in establishing this international standard. It was recommended at the Brussels meeting between the EBU and the American SMPTE. It was subsequently agreed at the CCIR meetings in Geneva.

The equipment is designed to transcode from SECAM to PAL without difficulties found in earlier techniques. It will attract great interest during the satellite tests. If the SECAM decoder is replaced by a high quality PAL decoder, the transcoder becomes a *synchronizer*. As such, it has none of the imperfections of the typical composite signal synchronizer. Also, because the input clock has been designed to follow the rapid changes in line length associated with some helical scan video recorders, the transcoder can operate as a *time base corrector*.

UHF transposers

Another BBC development is the Silver Streak UHF transposer equipment, designed to provide full broadcast quality equipment at minimum cost with maximum reliability for the BBC's program for relay stations serving areas of small population. It is manufactured and marketed with Continental Microwave.

The design requires no adjustment on site, achieved by using universal modules in which all active components are similar. A separate "personality" panel, which contains no active components, determines the frequency, offset, slope, maximum gain and power output by controlling the transposer's active module. If a fault develops, a replacement module is plugged into the associated personality panel. As the equipment is designed to allow modification, it is expected that transposers will become available for VHF television and for international standards.

British consortium for DBS

At the time of this writing, it is expected that Britain's home secretary, William Whitelaw, will announce legislation to allow direct satellite broadcasting to the United Kingdom. A consortium of three British concerns—British Aerospace, Marconi Avionics and British Telecom—will likely launch a £300 million project to build a direct broadcasting satellite. Named either TV-Sat or Britsat, it will be financed by Satellite Broadcasting, a company set up by British Aerospace in conjunction with merchant banker N.M. Rothschild. The satellite is scheduled for launching on a European Ariane rocket in 1985 or 1986.

Although such projects are in the multimillion—be it pounds or dollars—bracket, British industry has its feet firmly on the ground and is developing a variety of interesting equipment.

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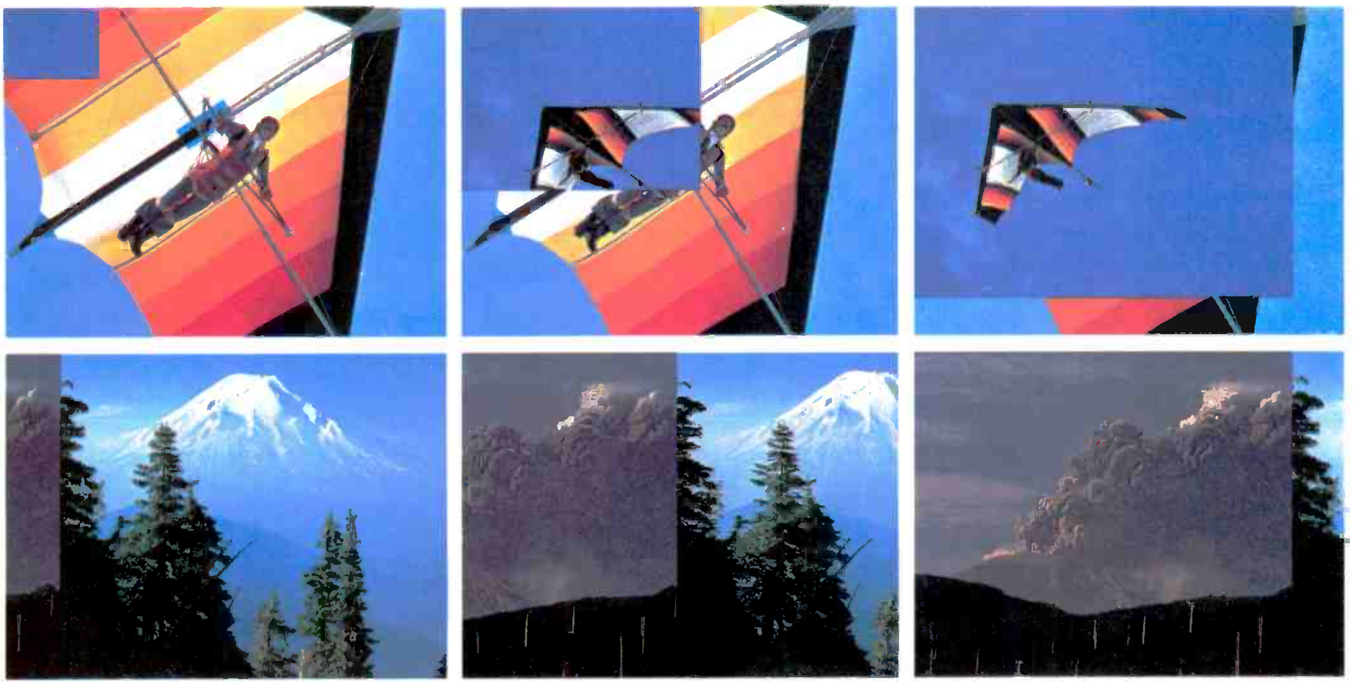

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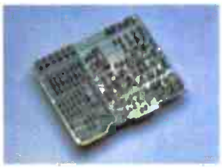
The AC 20 gives you two channels of digital time base correction in just seven inches of rack height, saving space, maintenance, capital cost, cooling, and power. The Production Remote gives you digital switching effects at very little extra cost.

In fact two channels of time base correction with 2:1 digital effects are priced at only $17,500.

Two of the effects are shown above: Corner Wipe, and Push Off. You also get Vertical Wipe, Vertical Interval Cut, Fade/Dissolve, Push On, and Pull Off, plus Reverse and Mid-Stop controls and a choice of four transition speeds. Not bad for a TBC.

This means that with three VTR's and an AC 20 (with the Production Remote option) in an editing suite, your ENG post-production crew is ready for A/B-roll editing with digital effects, some of which have only been seen on upscale switchers until now. No need to tie up your production switcher. And you can remote the AC 20 to your editor, if you like.



The AC 20 works with ¾-inch and ½-inch V-locked, unsegmented VTR's that accept derived 3.58 MHz feedback. It uses a 16-line store, eight-bit technology, and fourth-harmonic sampling to produce a broadcast-standard output. Its digital circuitry assures that the output signal is the same quality as the video input signal. It is virtually transparent. And it is modular; you can start with a single correction channel and do cuts-only editing; you can add a second channel and move up to A/B rolls. You can add the Production Remote for digital transition effects. And that's just the beginning. The AC 20 TBC is the first of a new family of products that will have a significant influence on the future of broadcast production equipment.

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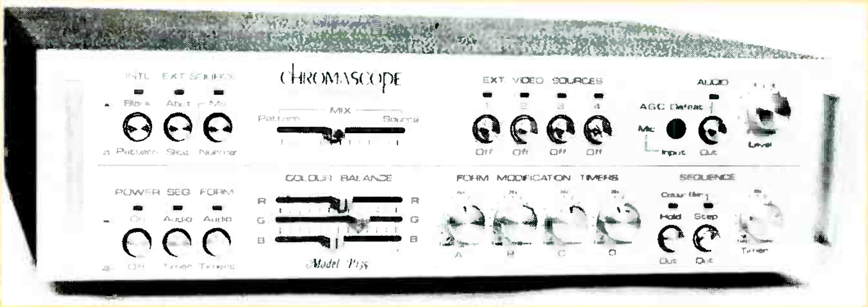
The CEI-300 microprocessor-controlled broadcast color TV camera. Note the visual setup prompt.



The Chromascope P135 video synthesizer is now available in an NTSC version from CEL Electronics.

color cameras now feature such automatic setup functions as white balance, black balance, white and black levels and picture size. Even so, their automatic ranges can be exceeded and, under field production conditions where ambient light conditions can change almost instantaneously, an operator can easily make mistakes. Consequently, microprocessor-controlled features of the CEI-300 series of cameras from Crow of Reading are significant. Instructions from the microcomputer, visible on the viewfinder and monitor screens, give instant guidance to the operator when an adjustment is beyond the auto range. Instructions are in plain English superimposed on the picture and include prompts regarding mode settings, as well as unambiguous directions for manual adjustment.

When operating in natural light, color temperature may change beyond the camera's auto white balance range. This can be checked instantly against any small white area—corresponding to about 5µs on a single raster line—in the scene. If balancing is required, a flashing "W" appears in the lower left hand corner of the screen with a brief instruction for adjusting the manual controls (for example, *turn gain up* or *turn B up and R down*). When auto balance takes over, the flashing W disappears. The complete adjustment takes less than half a second.

Video synthesizer

The Chromascope P135 video synthesizer from CEL Electronics has been available only in a PAL 625 version. Now, an NTSC version has been produced. The new synthesizer provides the same facilities as the PAL version, and accepts such sources as a videocassette recorder or a live camera. The unit incorporates external images in patterns and can superimpose patterns, shapes and colors onto the images provided. It will even put color into a black-and-white picture. It creates a constantly changing design of abstract, multicolored images.

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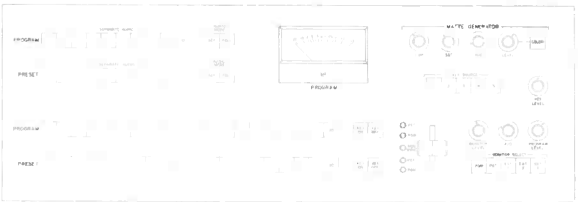

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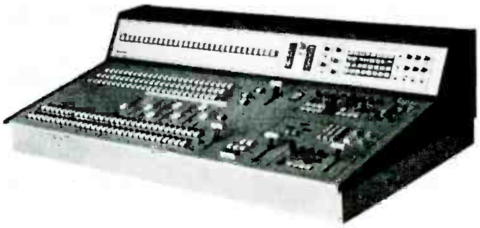

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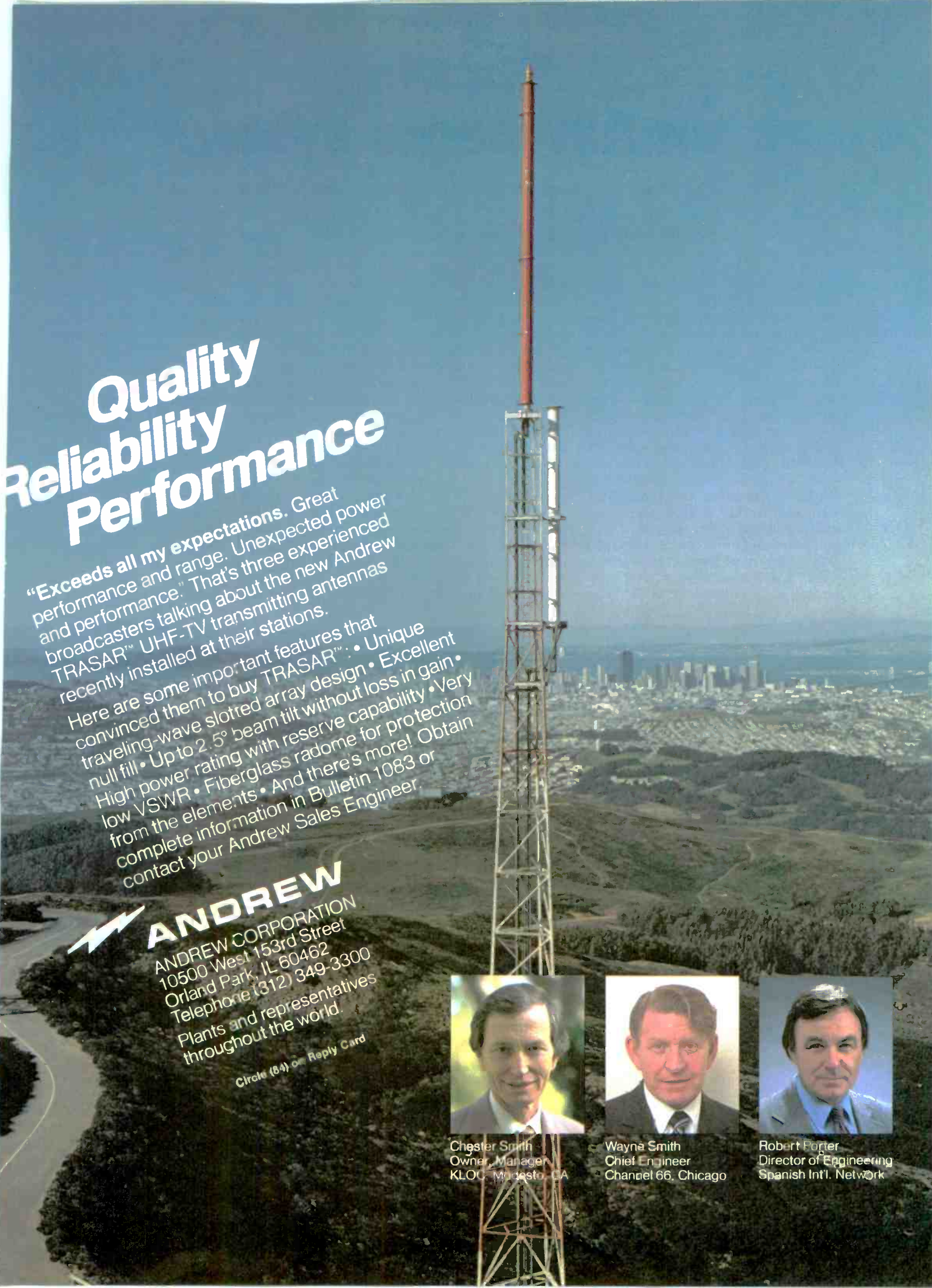
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Creating an AM stereo system

By David Hershberger, associate principal engineer, Broadcast Division, Harris Corporation, Quincy, IL

Designing an AM stereo system in a vacuum would be much easier than doing it in the real world. Without having to concern themselves with existing transmission or receiving equipment, engineers would probably converge on a pure quadrature AM stereo system. Such quadrature techniques are used in color TV transmissions, proposed FM quadraphonic systems and in many sophisticated communications and data systems. A pure quadrature system would require no additional bandwidth, would provide excellent signal-to-noise ratio, and would be totally compatible with synchronous detection. The problem in the real world is that there are millions of AM mono receivers in the field, virtually all of which employ a single diode as an envelope detector.

All AM stereo system proposals have to go through the NAMSRC and the FCC, seeking approval. The pure quadrature system seems ideal in almost every aspect, except that its harmonic distortion through a narrowband envelope detector measures higher than what is expected by today's high fidelity standards. Many people are influenced by comparative numbers, so a system that does not look good on paper might never get off the ground. However, the problem with these distortion measurements is that *they don't correlate with what the listener hears.*

Numerous tests in the United States, Japan and Europe have demonstrated that listening to a pure quadrature system through an envelope detector produces no objectionable listening characteristics. The measured distortion is mainly second order in nature and is closely harmonically related to the original program. In fact, several manufacturers of power and musical instrument amplifiers deliberately increase the second order harmonic content to make their units sound more powerful.

In designing the Harris linear AM stereo system, the company started with a quadrature (90°) system and sought ways of improving how the system measured. Reducing the modulation angle from 90° to 30° created a system that measured well, sounded good on envelope detectors, and operated as well as an AM stereo system.

Further experimentation developed the present linear AM stereo system, which varies the transmitting angle as a function of the L – R content of the program. The system senses possible measured distortions that could occur in envelope detector receivers and compensates for this condition by

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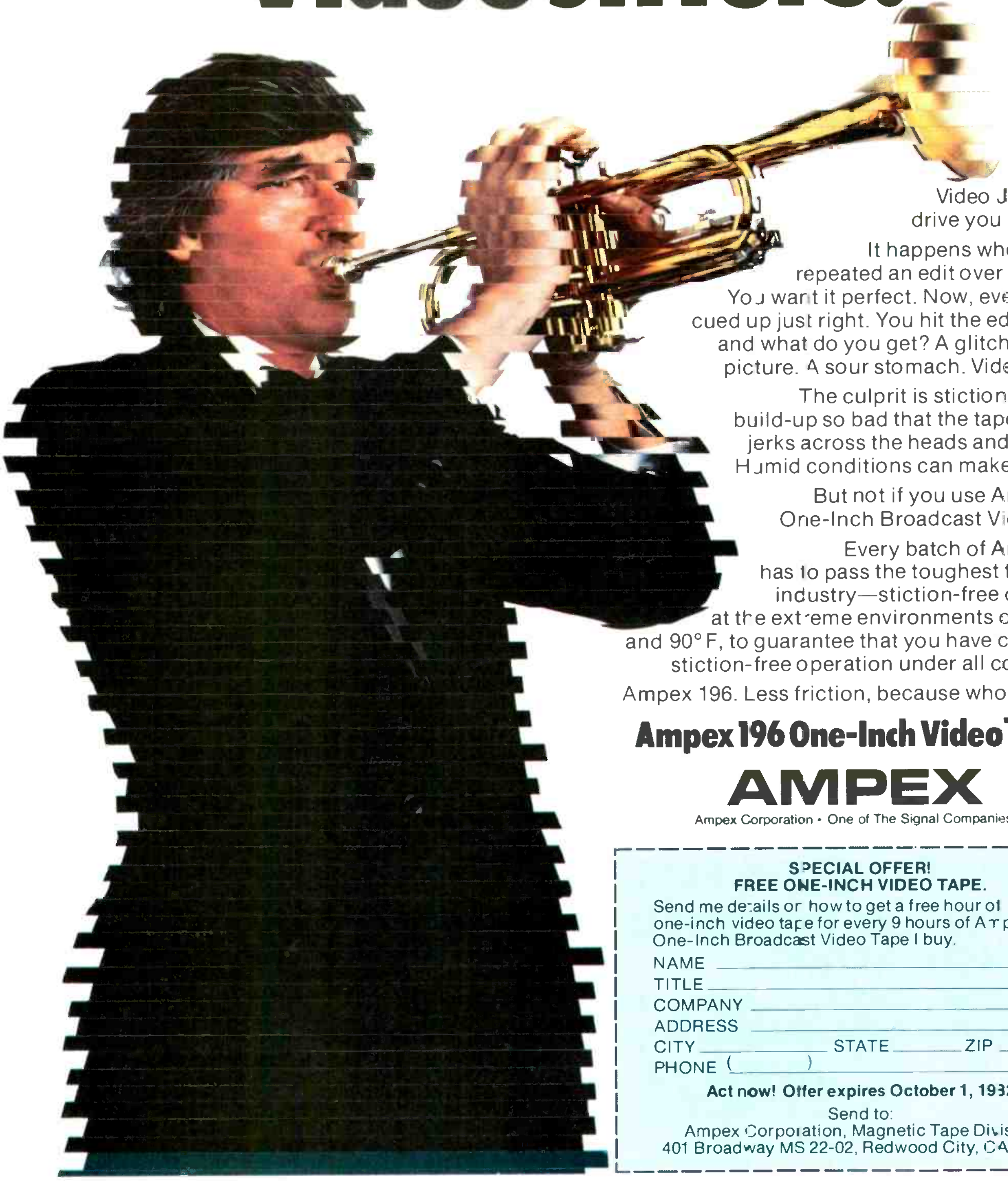

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altering the L−R channel at the transmission end. This dynamic control information is conveyed via the stereo pilot tone, which tells the receiver circuit how to properly decode the signal.

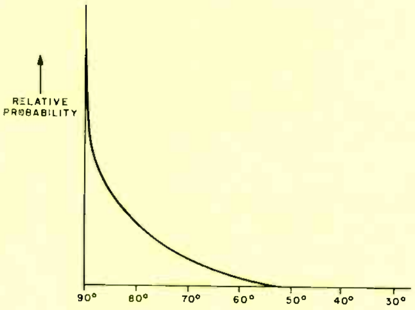


Figure 1. Approximate probability density function for Harris linear AM stereo program material transmit angle.

Exhaustive laboratory and field tests on various types of program material (such as music and speech), show that the system tends to be a quadrature system most of the time. (See Figure 1.) The smallest angle ever observed was 45°, observed once in the lab and once on air tests at CKLW, an AM radio station in Canada. The probability curve derived from long analysis of the system indicates that 99.9% of the time no more than 4.5dB of gain control is required. This is conservative when one considers that Dolby B uses about 15dB and dbx up to 50dB.

The design criteria for the Harris linear system was based on five key objectives:

- **conservative use of AM spectrum**—As any nighttime AM radio listener can testify, there is tremendous congestion on the AM broadcast band in the United States. The condition seems much worse in Japan and Europe when one considers that there is at least one, and often many, megawatt stations operating on each AM frequency authorized in Europe and Asia.

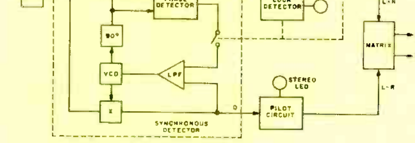
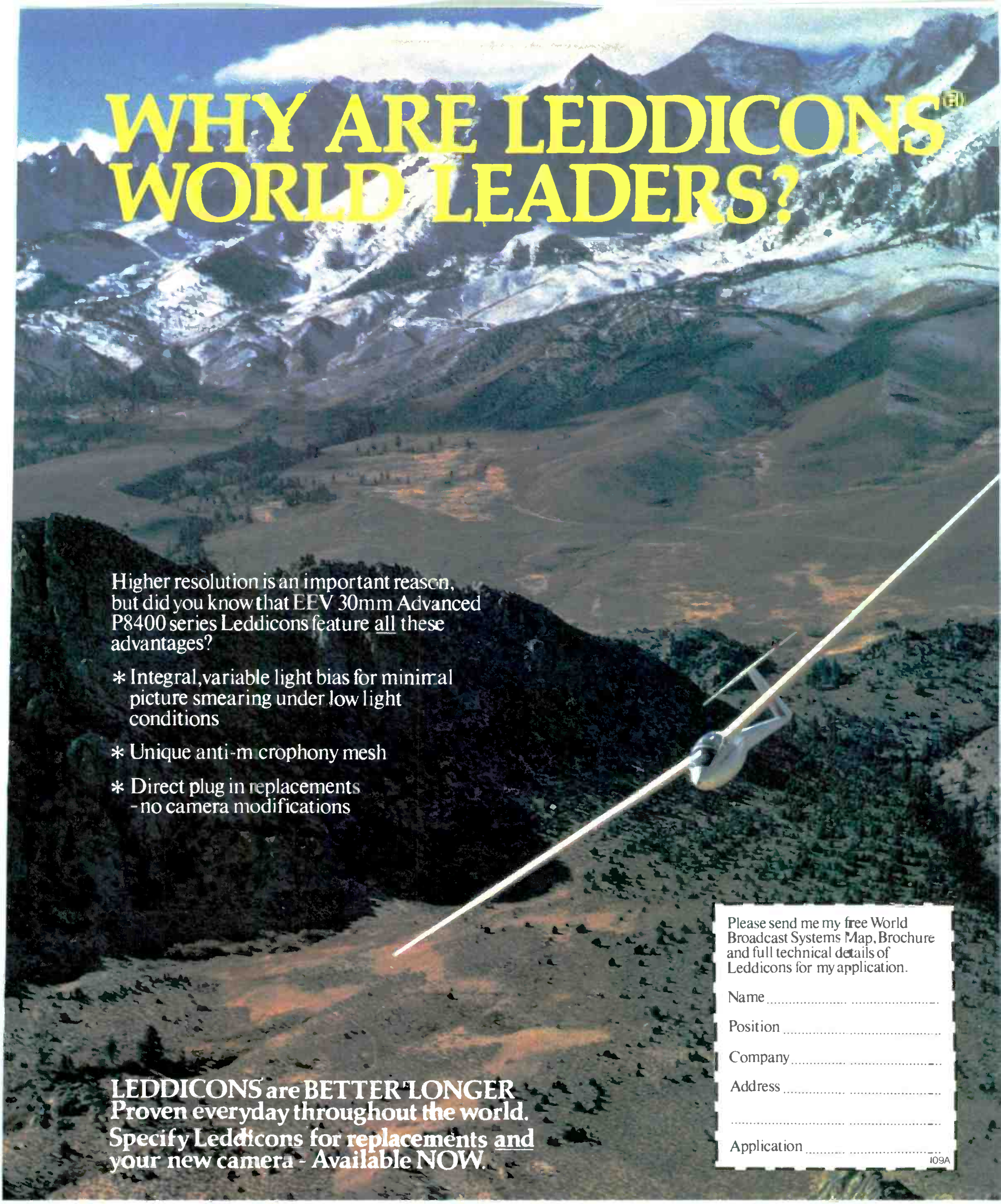


Figure 2. Block diagram of Harris AM stereo receiver.

The Harris system was designed to allow maximum fidelity transmission of an AM stereo signal without increasing the required bandwidth. (See Figure 2.) This is different from other systems proposed, all of which re-



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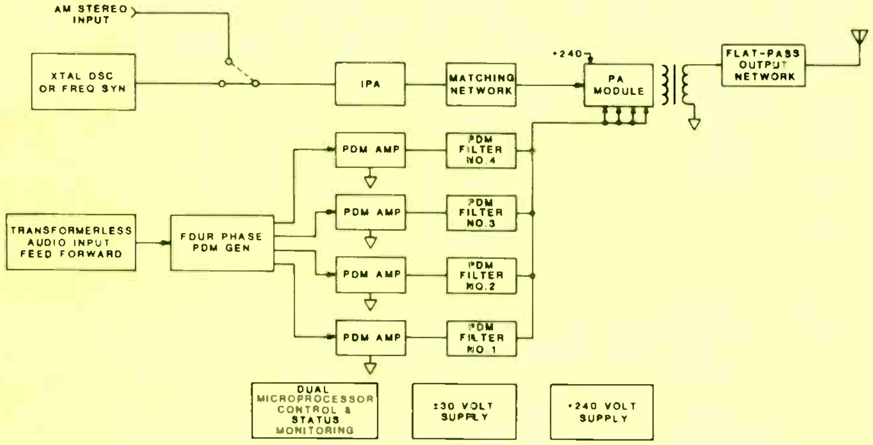

Figure 3. Block diagram of Harris AM stereo transmitter, the SX-1, 1kW solid-state AM transmitter.

quire increased bandwidth to accommodate the sidebands of their stereo transmissions. These systems could never be considered for European or Asian broadcasting, because stations there are already on 9kHz spacing. Any increased bandwidth occupancy would severely increase the overall interference level.

- **full audio fidelity from 50-15,000Hz**—If AM stereo is to survive and prosper it must offer the listener a service almost as good as FM stereo. If the bandwidth is limited to 5kHz or 8kHz, as it is in most other systems, the listening public will not perceive a substantial user benefit from AM stereo. The "gimmick value" will quickly wear off and listeners will return to their FM stereo habits. The Harris system provides a full fidelity transmission system compatible with existing mono receivers.
- **easy interface with existing transmitters and antennas**—For an AM stereo system to be successful, it must interface easily with the existing transmitter, antenna system and phasor in a directional array. Because some systems have increased bandwidth requirements, they may require modification of the antenna and phasing systems. Failure to make the antenna system broadband enough to accommodate the AM stereo signal of these other proposed systems could result in high distortion at the receiver.

Harris estimates that required modifications on a typical AM station could cost between $5000 and $60,000, and could mean that the station would have to sign off or operate at reduced power for an extended time while modifications are made.

- **compatibility with pre-emphasis**—In a recent survey, more than 57% of AM broadcasters said that they are using pre-emphasis on their AM stations. Another 14% said that they planned to install pre-emphasis in the near future. Pre-emphasis in AM radio trys to overcome the poor received quality and limited frequency response on most home and car AM radios. Pre-

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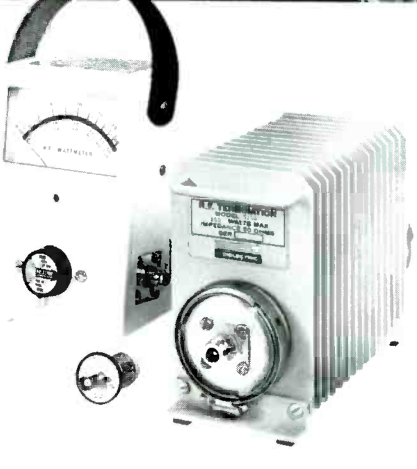

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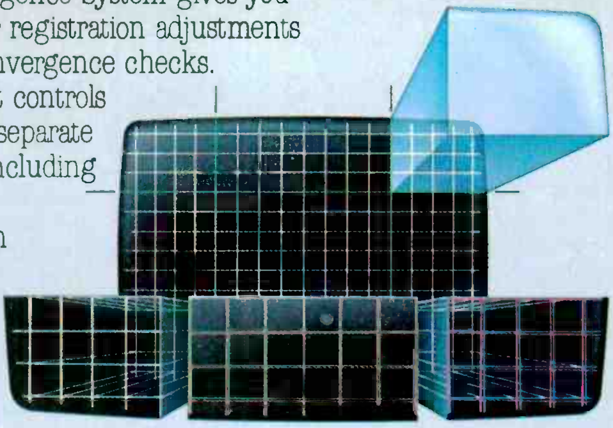

Conrac's Active Convergence system lets you adjust color registration on nine separate areas of the CRT.

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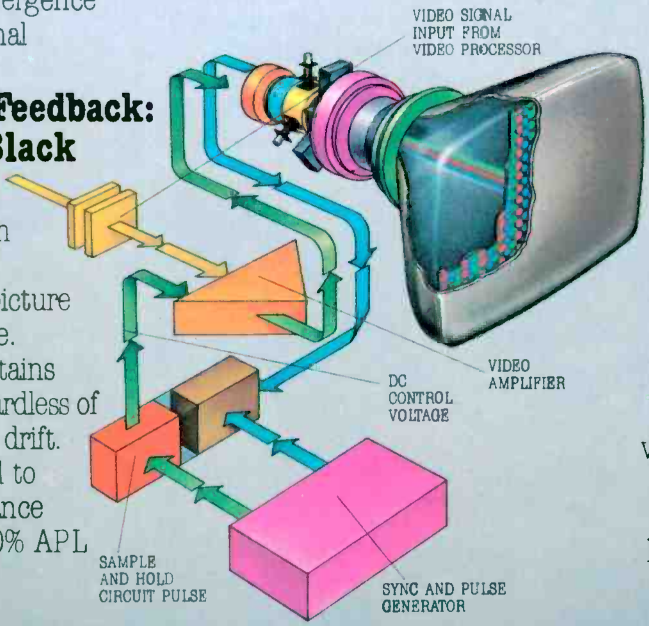
Conrac's exclusive Beam Current Feedback system automatically maintains black level stability.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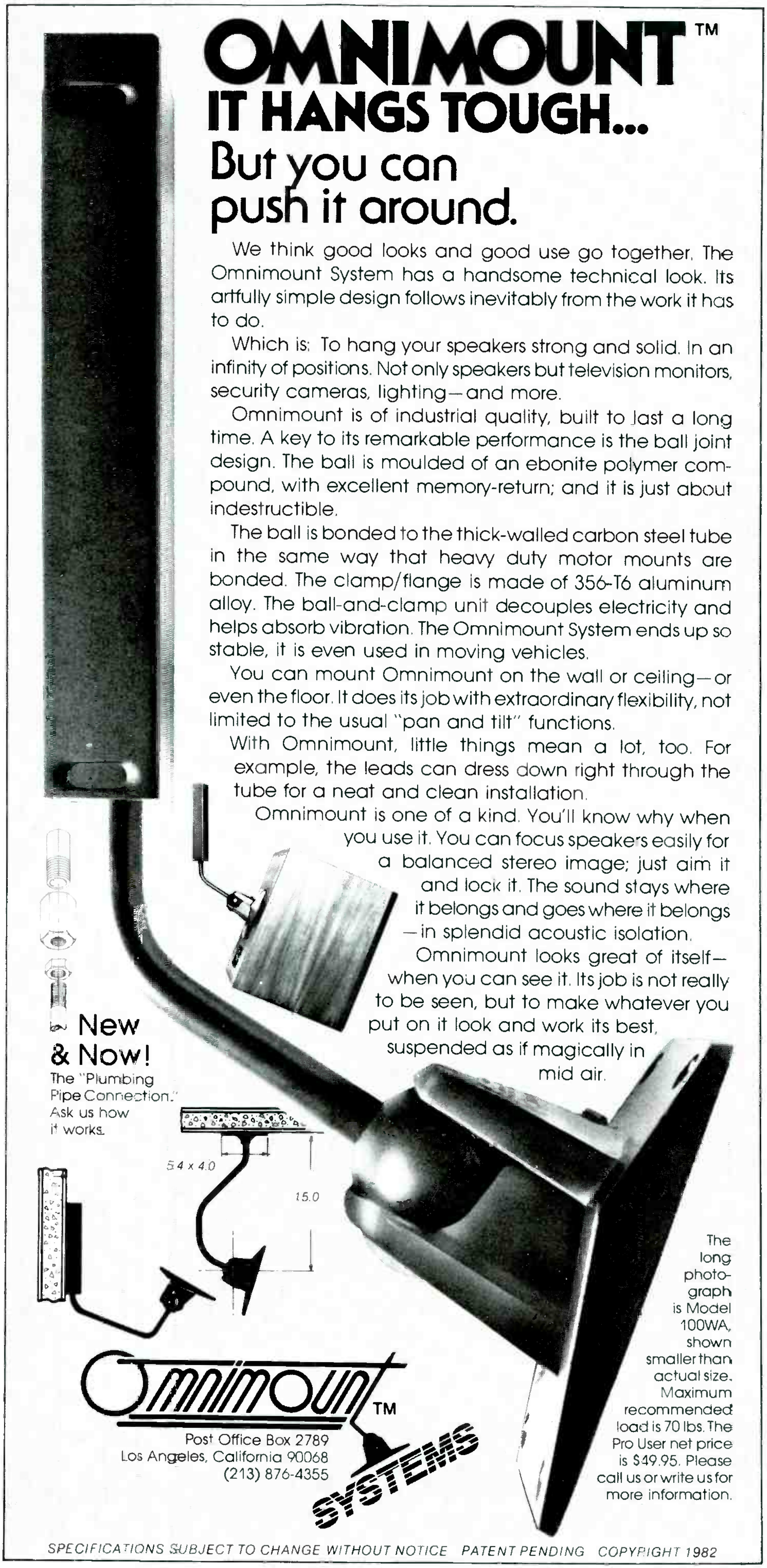

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emphasis will dramatically increase the occupied spectrum of all proposed systems except the Harris system.

The RF bandwidth problem of nonlinear systems, made worse by pre-emphasis, causes another problem: distortion. In linear systems, such as AM mono or Harris AM stereo, a typical radio receives only the middle 5kHz of a 30kHz signal, causing a simple roll-off of the high frequencies, but no distortion. Non-linear systems transmit wideband predistortion sidebands that are rejected by typical radios, resulting in 15% to 25% distortion. Pre-emphasis makes the problem even more severe.

Unlike the other systems, the Harris linear system is not distorted by radio IF filtering. In Appendix E of the FCC Report and Order, strong statements address this characteristic: "A major strength of the Harris system is that necessary bandwidth limiting in receivers does not introduce distortion in the recovery of the transmitted signal...Because of this, the Harris system is the only one of the five systems for which a receiver can be built which theoretically does not introduce distortion as part of the decoding process."

If an AM station began transmitting any AM stereo system other than the linear system with continued pre-emphasis, the station would probably create out-of-band emissions and excessive distortion in stereo and mono receivers, and would be forced to reduce or eliminate the pre-emphasis. (See Figure 3.)

- **take full advantage of synchronous detection**—Synchronous detection in home and car receivers is the only way to create a high fidelity AM stereo service. With synchronous detection, the IF bandwidth of AM radios can be greatly increased without attendent increase in noise, distortion and interference, which would be present with envelope detectors.

Because the Harris system is the only *linear* system, it is presently the only one that is totally compatible with synchronous detection, as was mentioned in Appendix E of the FCC Report and Order on AM stereo. Also, this system is compatible with non-synchronous detection, which may be an important factor in the production of low cost medium quality AM stereo receivers.

Each of the previously mentioned objectives has been met. The company has developed a system that is compatible in the broadcast environment and that will offer quality improvements to the AM stereo listener today and in the future.

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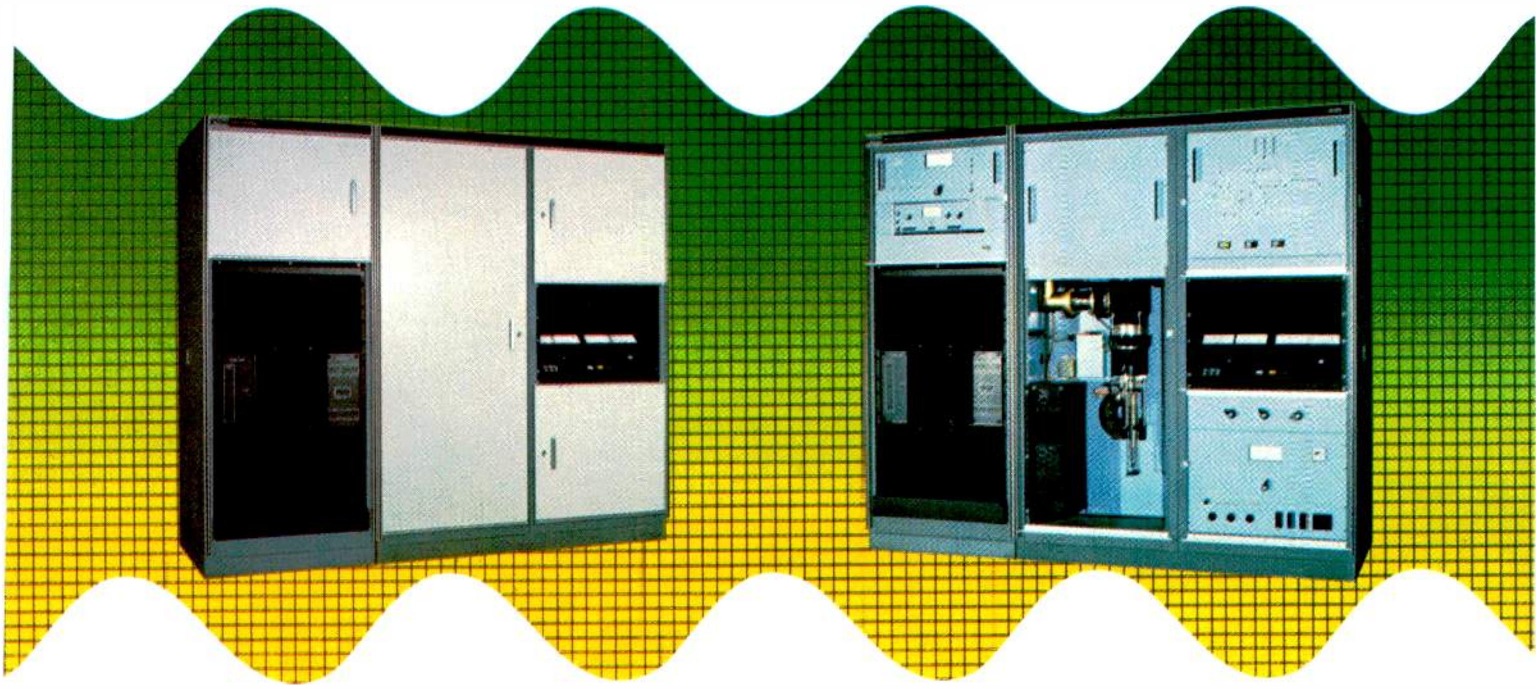

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The technical proposal: An engineer's bridge to management

By John M. Cummuta, chief engineer, KNEI-AM/FM, Waukon, IA

For a more efficient team effort in the broadcast environment, the engineer must become a part of management decisions. Communication is the key to that involvement.

Recently, members of the broadcast industry have been calling for more engineering participation at the management level. The main obstacle to this participation has been *communication*. Engineers must go beyond *speaking electronics* to become more involved in management decisions.

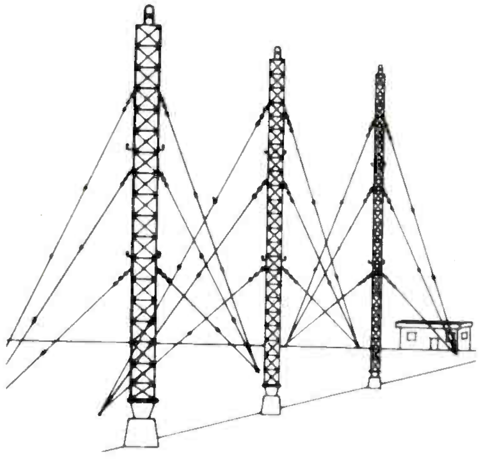
To gain acceptance on the management team, the engineer has to do two things: He must gain a deeper understanding of how other departments affect the health of the station, and he must learn to communicate his ideas in terms with which management can identify. Whenever an engineer presents an idea of importance, he must answer management's questions: "What?", "How?", "When?", "Why?" and "How Much?".

Most engineers' point of contact with management is their involvement in some station activity or plan. It may be the engineering angle on a remote broadcast, the engineering response to a competitor's latest move, or the engineering solution to an ongoing problem. In any case, the engineer is called upon to solve it or simply implement a decision already made by the manager and some other department head. The point of contact is the same whether you are an in-house engineer, or a contract or consulting engineer; the difference being the depth of your knowledge of the station, its personnel, community and resources.

In either case, your mission is to respond with confidence to management's call, and to communicate effectively what you offer in that response. The *technical proposal* is a tested and successful method of bridging the communications gap between technicians and their non-technical managers. And the professional image projected by a well-constructed proposal goes a long way toward winning its author respect and repute from management.

The technical proposal bridges language or jargon barriers and focuses management energy where it will accomplish the most good. First, it identifies the problem in objective and basic terms. Next, it proposes the solution(s). Then it presents alternatives for management's consideration. It answers management's favorite questions, including the cost, and finally, it clearly presents your strong endorsement for the suggested course of action.

A technical proposal is an extended memo with sufficient structure and



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INTRODUCING

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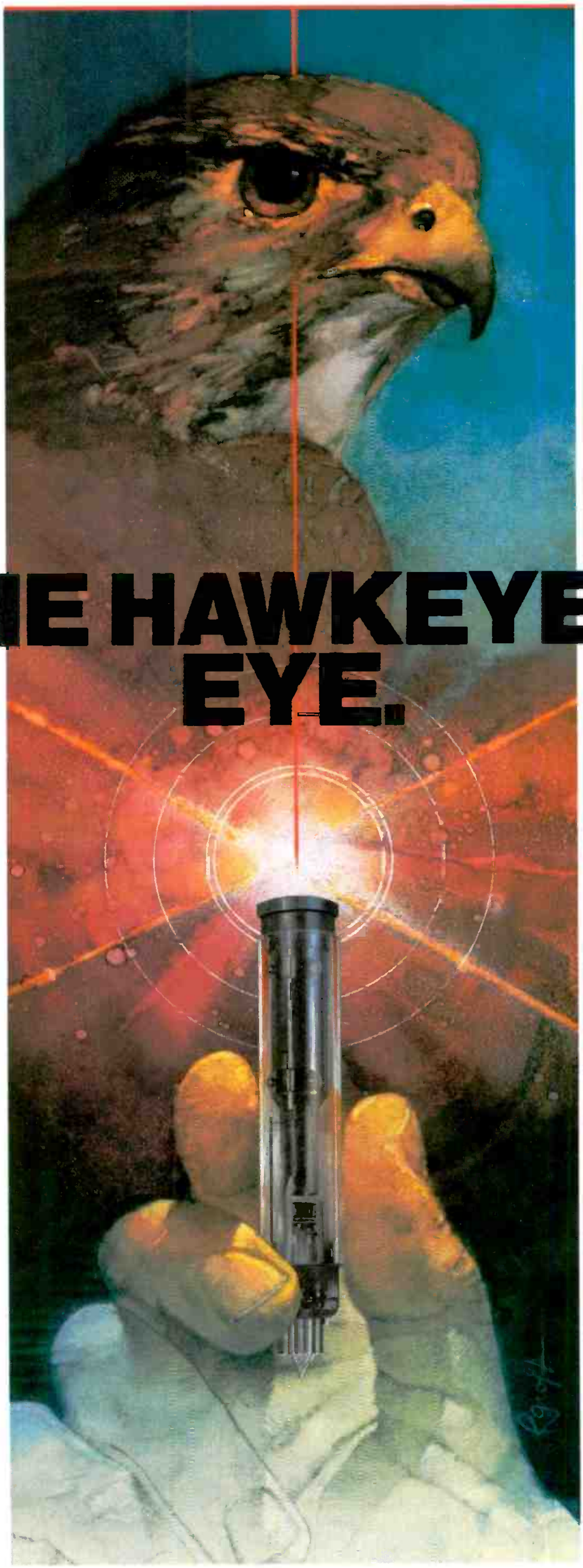

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SATICON tubes are now available as new or replacement equipment for most ENG, studio and remote cameras. For more information, please write RCA Camera Tube Marketing, New Holland Avenue, Lancaster, PA 17604. Telephone: (717) 397-7661. Or RCA Brussels, Belgium. Sao Paulo, Brazil. Sunbury - on - Thames, Middlesex, England. Paris, France. Munich, W. Germany. Hong Kong. Mexico 16 D.F., Mexico.

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I. Summary
  (text)
II. Introduction
  (text)
III. Discussion
  A. Objective
  B. Proposed solution
  C. Alternative solution(s)
  D. Evaluation
IV. Recommendation

Figure 1. Technical proposal format

substance to move management. It follows a *summary-background-facts-outcome* format that flows logically from the presentation of the problem or project to the recommended solution or plan. (See Figure 1.)

A brief *summary* of the problem is the first element in a successful technical proposal. This can be a problem that management has asked you to solve or a project that you have identified that would benefit the station. The problem and your solution will be defined more clearly later in the proposal; the summary is just a general preface.

An *introduction* section should be the next ingredient in your proposal. The introduction accomplishes two important goals: It clearly defines the problem to be overcome or the goal to be reached, and it establishes exactly why it is a problem or a goal toward which to strive. The proposal is structured much like an outline, and the introduction segment should contain necessary subsections describing each element of the problem, such as effect on equipment, long-term costs and human engineering.

Now that you have clarified what you are up against with the summary and introduction, it's time for a *discussion* of how the problem can be solved, or the goal reached. There are four segments to this discussion:

- The *objective* is a definition of parameters or criteria for an ideal or acceptable solution. This tells management what you see as the best possible outcome.
- The *proposed solution* is just that. You should define what it is, the result it would achieve, how your station would implement it, how much it would cost, and its advantages and disadvantages. Here is where you lay your cards on the table. Your motivation for writing a technical proposal in the first place was that you believed you had a solution for a station problem, or an idea that could benefit the organization. This is where you delineate all its assets and liabilities.
- *Alternative solution(s).* For each alternative, list what it is; the result it would achieve; how it would be implemented; its costs, advantages and disadvantages; *and why it is not as effective as the proposed solution.* There may be overriding facts known only to higher management that would make one of your alternatives the preferred solution. The fact that you present other perspectives shows your awareness of management's informational needs.
- The *evaluation* is a brief trade-off analysis. It refers to the objective and compares the effects of adopting an alternative, or taking no action. This is where your narrative takes management down the various paths, as you have evaluated them, and shows how yours is the true *yellow brick road.* It also makes clear that sitting idly at dead center will cause the situation to deteriorate, or at least not to improve.

The final element of a successful technical proposal is your *recommendation* for action. This should be a strong, positive statement of confidence in your program's ultimate success. Or, if your proposal is designed to secure permission for an expenditure or a certain course of action, your recommendation should be a direct and specific request. The key to this wrap-up to the technical proposal is *confidence.* If you don't really believe in what you're suggesting—don't write a proposal.

Format design may vary, but neatness and professional appearance are musts. The following are some suggestions:

- Put your proposal's title in caps at the top center of the first page. Also on the first page should be an identification of to whom the proposal is addressed and whom it is from, along with the date.
- Leave space between the proposal's sections so that the paper is orderly and easy to review. It would be a good idea to title the sections as well.
- Include any graphics or visual aids, such as block diagrams or flow charts, that will add to the clarity and comprehension of the proposal. Don't, however, add diagrams just to be impressive. Also, any lengthy visuals or sets of figures that might interrupt the flow of the narrative should be presented as attachments to the proposal and referenced in the text.

The technical proposal is a communications bridge between the engineer and the manager, and it accomplishes two important things: It helps the station solve its problems, and it defines its author as an effective member of the management team.

Cummuta is operations manager, as well as chief engineer, at KNEI. He also takes part in the University of Wisconsin clinic and conference programs for broadcast station management.

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Chinese television circa 1981

By John H. Battison, director of engineering, WOSU-AM/FM/TV, Columbus, OH

Last summer Dale K. Ouzts, director of the Telecommunications Center, and I were invited to visit Beijing (Peking) in the People's Republic of China. Our invitation came from the director of the Beijing Broadcasting Institute and included not only lecturing to the students at the institute but also untrammelled sightseeing in the Beijing area. As broadcasters we were particularly interested in the organization and operation of the Central Broadcasting Administration of China.

First impression

Before passing on to the TV portion of this article, I would like to pause in an attempt to convey this Westerner's reaction to the newly opened People's Republic of China.

Our arrival, six hours late, at 3 a.m. was hardly auspicious. Fortunately, our hosts were still waiting. A 40-minute, decorous drive at about 40 miles an hour down the tree-lined road from the airport was my first awareness of the strong feeling of peace in China. In fact, peace was the prevailing impression that I received during my stay. We saw very few automobiles on the road and no armed police, either in the city or in the outskirts. In fact, we saw none of the signs that I had anticipated in a Communist country. On the contrary, there were many groups of cyclists on their way to work.

Later, of course, we were overwhelmed by the multitude of cyclists in the city of Beijing and the lack of automobile traffic. However, this scarcity was more than compensated for by the efficient and frequent bus and electric trolley services that ran continuously throughout the city.

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Filters user changeable	NO	NO	YES
Continuous frequency tuning	NO	NO	YES
Calibrated output attenuator	YES	YES	YES
Selective voltmeter mode	NO	NO	YES
Battery operation	NO	NO	Option
Options field installable	NO	NO	YES
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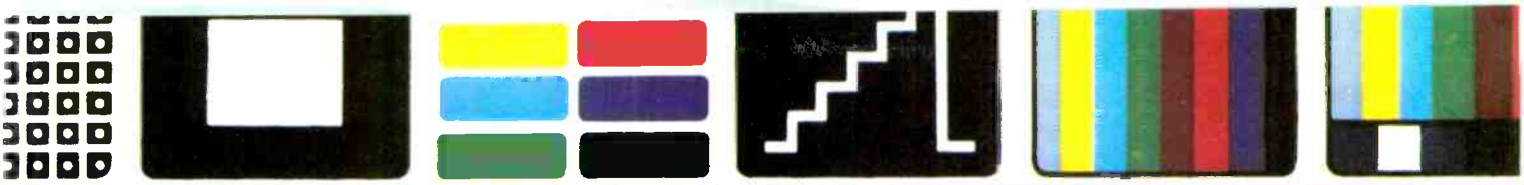

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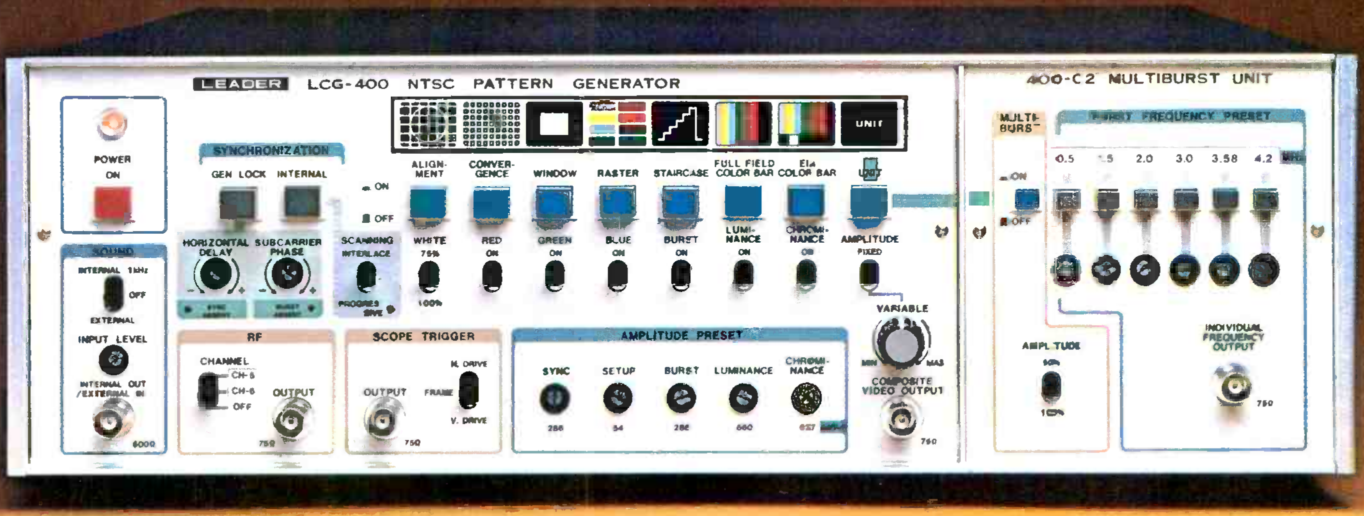
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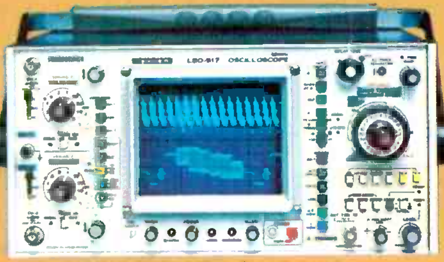

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casting Institute was a fascinating experience. It was founded in 1959 and was forced to close once during "The Cultural Revolution." The institute is the sole source of personnel for the Central Broadcasting Administration of China (CBAC). It has graduated more than 3000 students who have gone into the broadcasting and TV industry in the People's Republic of China.

While we were in Beijing, there were about 800 students with 276 teachers, including 197 professors and professorial staff. This staff is composed of specialists, journalists and radio engineers who are qualified to teach by reason of experience, education and training. Although, by US standards, the buildings are somewhat old and worn, the spirit and enthusiasm of learning is apparent.

We were shown the model of the new Beijing Broadcasting Institute buildings (Figure 1), a project to be proud of. Already one wing is nearly completed. This building will house the various foreign lecturers whom, it is hoped, will visit to pass on their experience to the students at the institute.

About 300 of the 800 students currently enrolled are in the undergraduate degree level in radio and TV engineering. The remaining 500 are devoting their energies to obtaining degrees in journalism, programming, announcing and similar program-oriented occupations. We were impressed with the enthusiasm shown by the students and the staff. Although classrooms were full—one class I attended had more than 100 students in TV engineering—there was no horseplay, and classroom behavior was exemplary.

Figure 2 was taken during a lecture on the subject of color TV receiver design and was a good example of student interest. Along the one wall of the classroom is a banner that advises the students: "You must overcome all difficulties you meet when you study." (I think this is something that many US students might do well to observe!) There was another notice beside the blackboard, saying: "You must be quiet."

The school is well-equipped with electronic training equipment. Reasonably sized studios provide facilities for students to practice camera handling and general TV production techniques. One item that impressed me considerably was an optical light demonstration showing how red, green and blue light combine to form all the hues in the color TV picture. Although basic, it was an authoritative demonstration.

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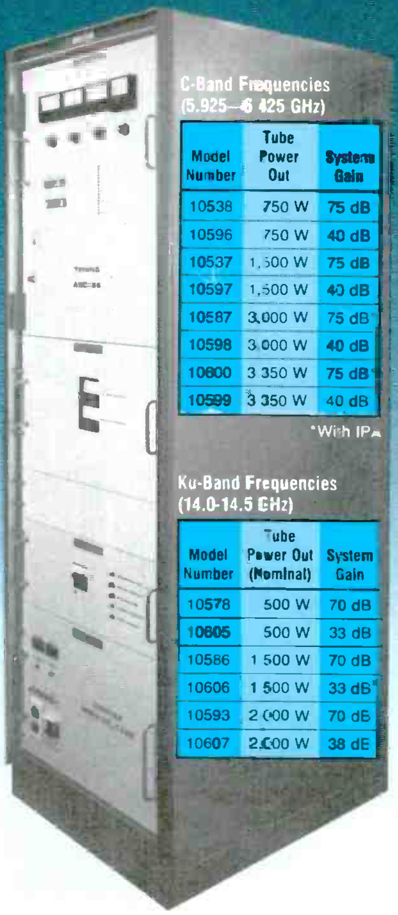

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10597	1,500 W	40 dB
10587	3,000 W	75 dB*
10598	3,000 W	40 dB
10600	3,350 W	75 dB*
10599	3,350 W	40 dB

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Model Number	Tube Power Out (Nominal)	System Gain
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10586	1,500 W	70 dB
10606	1,500 W	33 dB*
10593	2,000 W	70 dB
10607	2,000 W	38 dB

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In addition to a 4-year undergraduate course, a 3-year postgraduate course is offered for a few responsive students. It was interesting to note that many of the commercials seen on television in Beijing were made by the

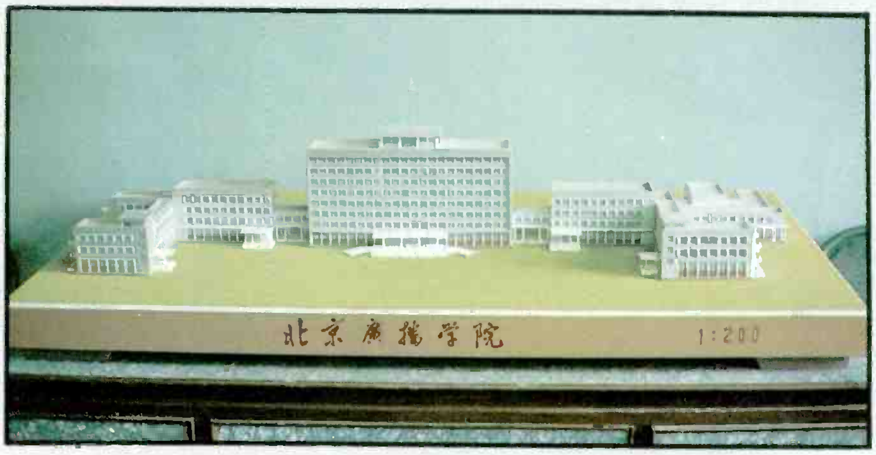


Figure 1. Architect's model of Beijing Broadcasting Institute's new buildings.

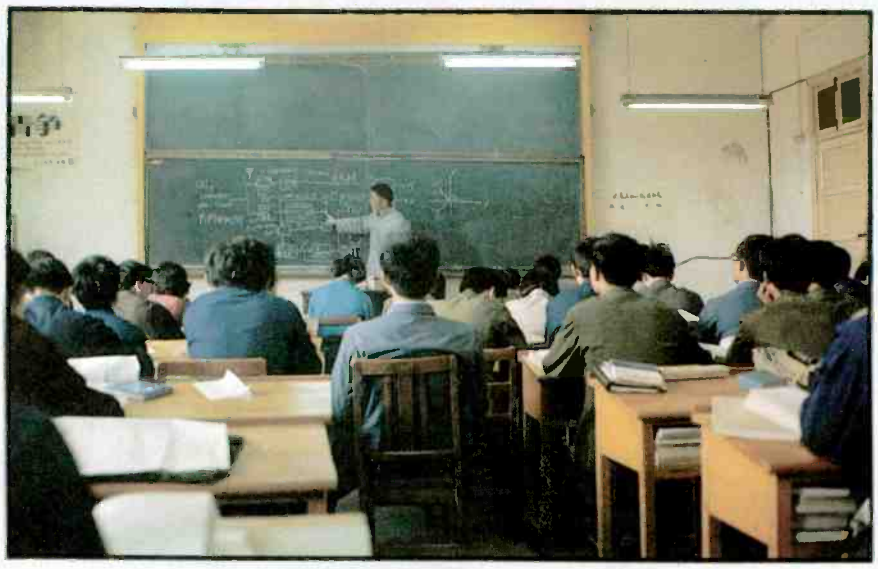
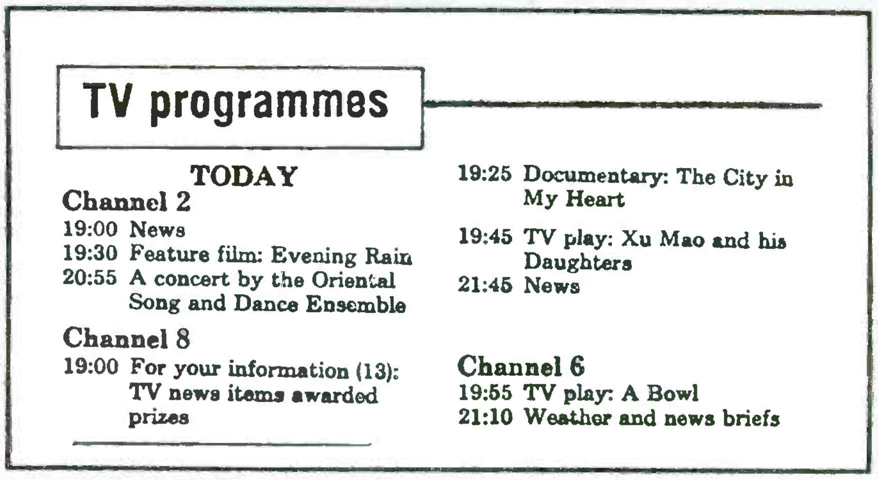


Figure 2. Typical Beijing Broadcasting Institute engineering classroom.



TV programmes

TODAY

Channel 2
19:00 News
19:30 Feature film: Evening Rain
20:55 A concert by the Oriental Song and Dance Ensemble

Channel 8
19:00 For your information (13): TV news items awarded prizes

19:25 Documentary: The City in My Heart
19:45 TV play: Xu Mao and his Daughters
21:45 News

Channel 6
19:55 TV play: A Bowl
21:10 Weather and news briefs

Figure 3. A clipping of the Beijing TV program, May 19, 1981.

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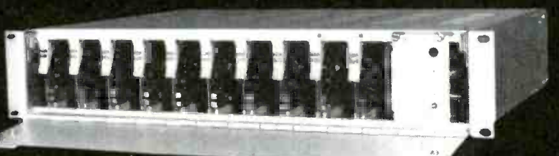

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staff and students of the Beijing Broadcasting Institute using the institute facilities.

TV broadcasting

As I mentioned earlier, one of the things that struck me was the feeling of contentment and peace that I found everywhere I went in Beijing. I was also impressed greatly by the industriousness of the people and the conscientious way in which they went about their work. Probably because of the long working hours, Chinese television is generally aired only during the evening hours. Figure 3 is a clipping of the Beijing TV program for Tuesday, May 19, 1982. Although these programs were printed in English (they were in the *China Daily*, the English language paper), all the programs were in Chinese. Although most of the programs are produced in China, a few dubbed syndicated programs are also aired from time to time.

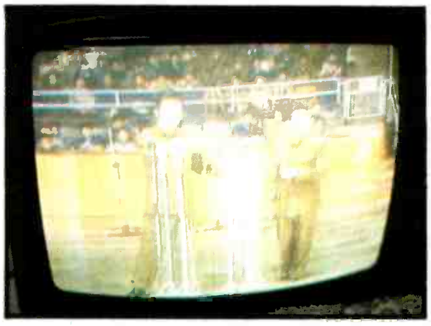

Figure 4. Crosstalk straight man and comic were so good that we often laughed although we did not understand Chinese! Note numerous microphones.

The hotel suite was supplied with a 21-inch color TV receiver that was made in China, and it worked well on its indoor antenna. The ghosts that appear in Figure 4 were unavoidably introduced by the rabbit ears in the room. Operating on the PAL-M system using 625 lines and 50 fields per second, the system provides higher definition than NTSC (525 lines, 60 fields). Many of the smaller cities have single VHF TV stations interconnected by microwave to carry the national program.

The studios we saw at the Central Broadcasting Administration were smaller than we are accustomed to in the United States and the equipment was not new. However, they were well-maintained and, once again, the spirit of *striving to work to the best of one's ability* was apparent among the broadcast staff.

Notice that the programs on all three channels start at 7 p.m. and run about three hours. With such a short program period available daily it

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might seem that $290 for a black and white receiver, and about $800 for a color receiver is a high price to pay. It is, because a large portion of the general workers, and even the professional staffs, receive less than $100 US per month. But because the state makes available all the necessities of life at unbelievably low cost, it is not as unusual as one might expect to find citizens enjoying the benefit of monochromatic or color television.

Channel 2 is small and basically the central TV source. The same national program is carried nationwide. On holidays, the programs may run later than 9 or 10 p.m. and in the afternoon. Educational programming is often available on Mondays, Wednesdays and Fridays between 9 and 11 a.m., and sometimes on Tuesdays, Thursdays and Saturdays from 5 to 7 p.m. These instructional programs are aimed at all segments of the viewing population.

Channel 6 is basically the local education channel, although none of the three channels carries concentrated special interest offerings.

Channel 8 appeared to be a general entertainment program. To our surprise, most of the commercials that we observed between some programs were for large pieces of machinery such as earthmoving, diesel or similar heavy manufacturing items. There were some Beijing consumer goods, and these were generally the type produced by the staff of the Beijing Broadcasting Institute.

The production techniques that we observed were interesting, and reminiscent of our own earlier US days of television. Many of the plays appeared to originate in either a public theater or a studio theater/stage. Microphones were much in evidence (Figure 4), across the front of the footlights and, because of this, sometimes the sound was less than perfect. In some of the other productions the sets seemed to be shallow. Production was sometimes reminiscent of the early days of live television before VTRs removed spontaneity from television.

On several evenings international news received by satellite was telecast. Several of these were from the United States, and snatches of English could be heard underneath the Chinese language dub. Antennas for the three TV services are located atop the Central Broadcasting Administration's building, and the familiar *batwing* antennas can be clearly seen on the tower of the building (Figure 5.) There are probably about 8 million TV receivers in use in the People's Republic of China today. The number is increasing, but rather slowly.

Summing up, TV broadcasting in

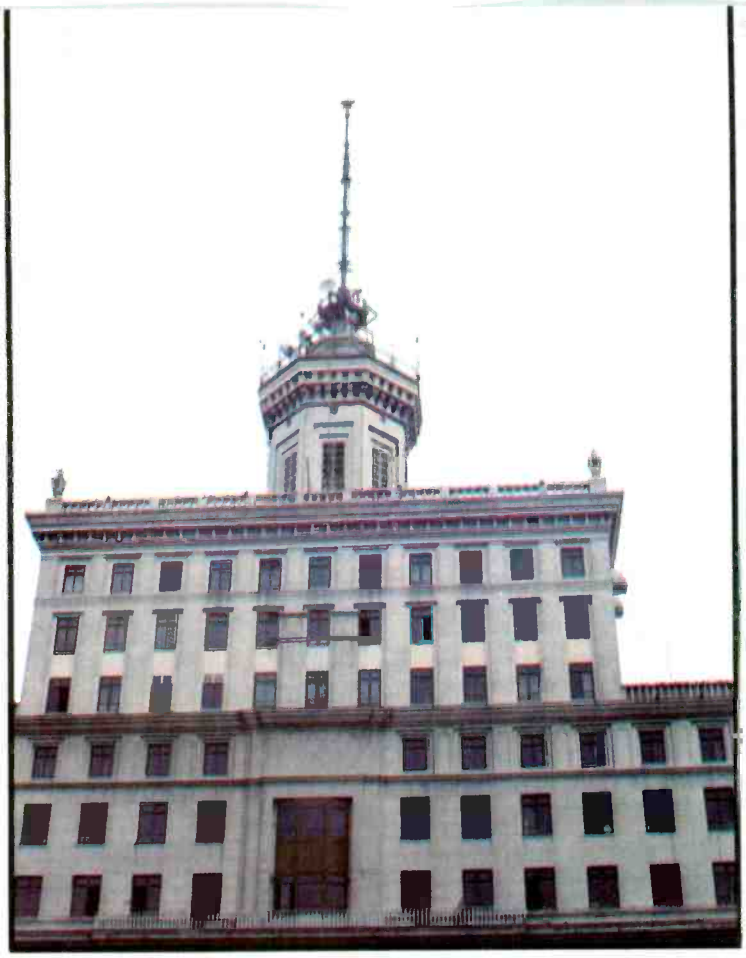

Figure 5. Central Broadcast Administration of China Building. Note *bat-wing* antennas on roof.

China is regarded with far more respect for its *educational potential* than is frequently apparent in the United States. The need, interest and drive on the part of the Chinese people to improve themselves and to develop the scope and usefulness of their broadcasting system was apparent. One of the biggest problems that China faces today in the expansion of its broadcasting facilities is a scarcity of qualified broadcast personnel. The Beijing Broadcasting Institute, which is the only one in the country, is doing its best to meet this demand, but it will be a long time before it is filled.

The time we spent in Beijing was a wonderful experience. It not only brought out the friendliness and industriousness of the Chinese people, and their genuine friendship and interest in the United States, but provided an insight into the TV and broadcasting industry of this *sleeping giant* nation. I left with the strong feeling of having brought something needed with me that was grasped with gratitude by the students. In return there was a feeling of appreciation and the sincere desire to know Americans better. I have accepted their invitation to return to lecture for three months, beginning this month.

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BE visits China

By Bill Rhodes, editorial director

As many of you may already know, last year we introduced the *Chinese Language Edition (CLE)* of **Broadcast Engineering.** On Feb. 9, 1982, Cam Bishop, publisher, and I went to China to visit with broadcasters and to do research for this year's *CLE.*

In a word, the journey was *magnificent.* If you ever get an opportunity to visit China, *go.* But call me first and I will give you some tips that do not appear in guidebooks.

The China leg of our trip included Beijing (Peking), Hang Zhou and Shanghai. We also visited Tokyo and Hong Kong. We toured radio and TV stations in Beijing and Shanghai, visited a broadcast equipment manufacturing plant in Beijing, and toured an electronics plant in Shanghai. In all three cities we held technical discussions with broadcasters that were quite enlightening. And, in Beijing, I lectured to about 200 broadcasters and administrators on new developments in radio and television throughout the world.

But, it wasn't all business. We toured each of the cities to see how the Chinese lived and worked. All information was freely given, and we were treated with unbelievable courtesy and hospitality. Also, the food and drink, especially the beer, were superb.

In Beijing we visited the Great Wall of China and climbed the east and west walls to the mountain peaks—perhaps the first Americans from our city ever to have done so. In Beijing we also visited the Ming Tombs, the famous Forbidden City, Mao's monument, and several beautiful parks.

In Hang Zhou, we cruised its famous lake, visited its parks with beautiful gardens and enormous pools of goldfish, attended a Chinese situation comedy play, toured China's second largest silk factory, and visited the famous Dragon Well tea site. In Shanghai we attended an evening of spectacular acrobatics and saw the performance of an exceptionally talented panda.

I think that the reception to our visit would have been welcomed simply because of the unusually polite attitude of the Chinese. But the success of our *CLE* publication lent dignity and prestige to our visit.

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Keep in mind that our *CLE* is the first publication of its kind available to Chinese broadcasters and that their thirst for reliable information on every aspect of radio and TV broadcasting is virtually unquenchable. It was interesting, almost amusing, to see that Chinese engineers are like all others—radio people want an all-radio issue, TV people want an all-TV issue, and they both want more, more and more technical data.

Much of the equipment was made in China, including the flying spot scanner in the background.

So, our technical discussions had an air of excitement about them. For the Chinese it was an opportunity to learn the latest from the West; for us it was the chance of a lifetime to visit a land of mystery and to present recent advances in broadcasting technology.

Our overall impressions are varied. FM broadcasting is in its infancy, an experimental phase that appears to be gaining rapidly in acceptance. Radio broadcasting itself is extensive, with programming in about 38 languages. TV is rapidly being modernized, with heavy emphasis on Japanese, American and European high technology equipment.

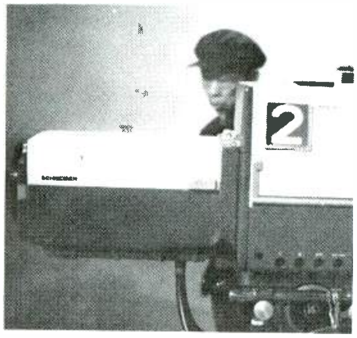
Three-camera techniques in color-program production have been common since the early 1970s, with recent modernization to 1-inch editing equipment and the latest in ENG and video switchers. (In fact, our Chinese translator was told by the engineers not to attempt translation of "ENG" because they understood the term as we do.)

Radio programming is mainly on reel-to-reel recorders, and both foreign and Chinese-made equipment was seen. Audio signal processing is just beginning, with the latest equipment from the West sitting atop audio consoles as engineers experiment.

Chinese engineers were eager to discuss broadcast trends in the West.

Programming for both radio and TV is strictly in-house or in-field, often with the BBC or other source material. Consequently, programming is severely limited, with priority emphasis on communications and education rather than entertainment.

To underscore the extent to which broadcasting is used in education, a *Broadcast College* links 36 of the 39 Chinese provinces. About 500,000 students are enrolled in this educational network that leads to a 3-year degree. Land-line microwave links are presently used for this system, but consideration of satellite distribution appeared to be food for thought.



Color cameras of both Chinese and foreign manufacture were seen.

Radio broadcasts are the most extensive, with more than 130 hours per day being broadcast in more than 38 different languages. TV broadcasts are more restricted. General programming, limited to about 30 hours per week, is mainly in the evening from 7 to 10 p.m. and on Sunday. However, educational TV programming averages about 10 hours per day.

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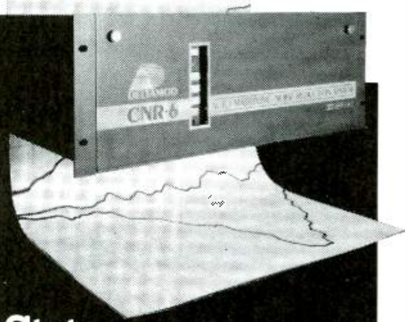

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Improving UHF transmitter efficiency

By Donald L. Markley, facilities editor,
D.L. Markley & Associates, Consulting Engineers, Peoria, IL

As power costs become more significant in broadcast operation budgets, users will seek more efficient transmitters as one means of cost reduction. The author looks at the status of efforts to improve the efficiency of current UHF transmitters and to develop new ones. Views from an engineering session on this topic held at NAB-'82/Dallas are also included.

The increase in cost of electrical energy in the United States and other countries around the world is causing operators of high power UHF stations to continually seek methods for improving the efficiency of their transmitter final amplifier stages. When the 4- and 5-cavity klystrons were introduced in the UHF market

Continued on page 122

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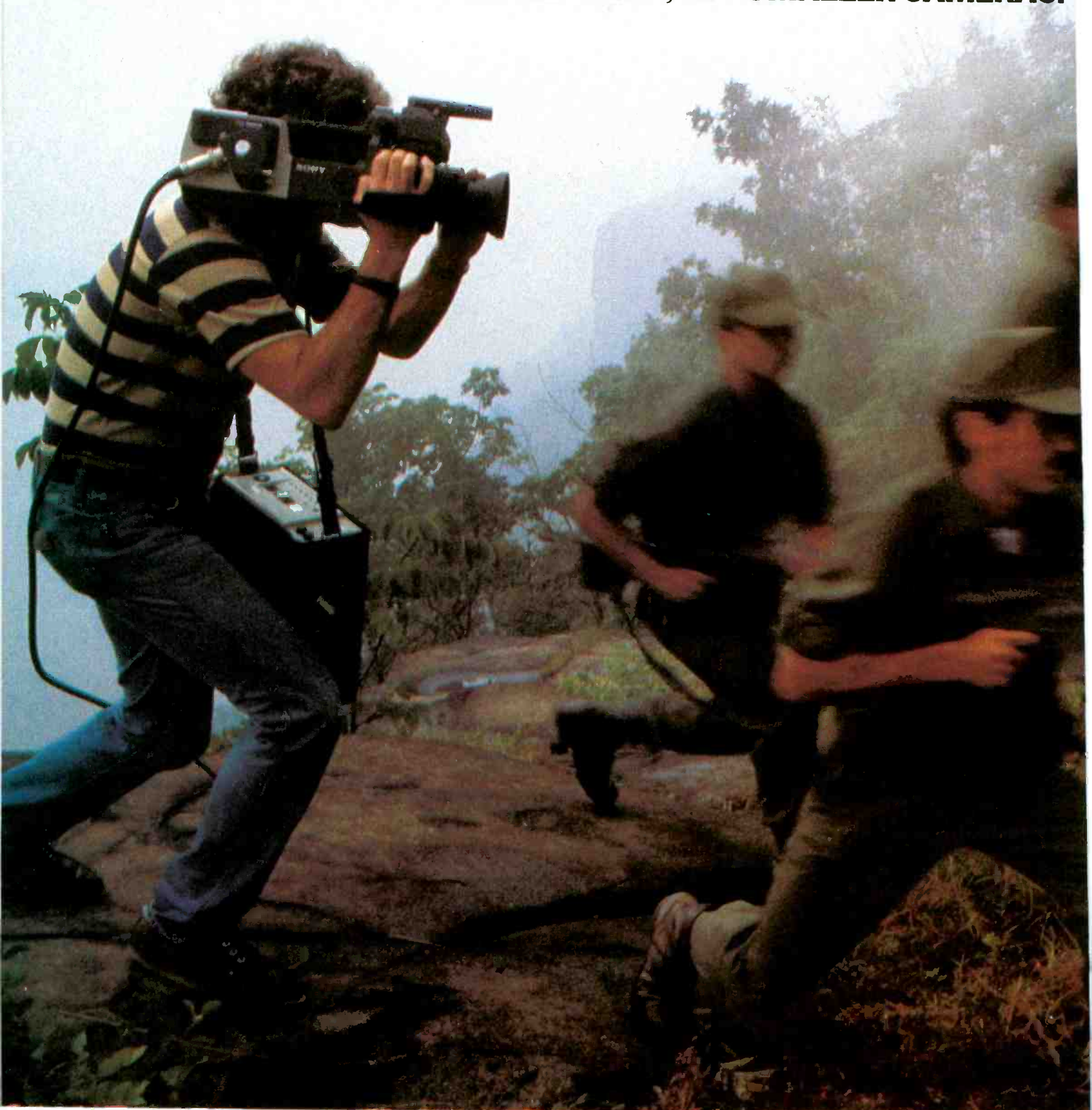

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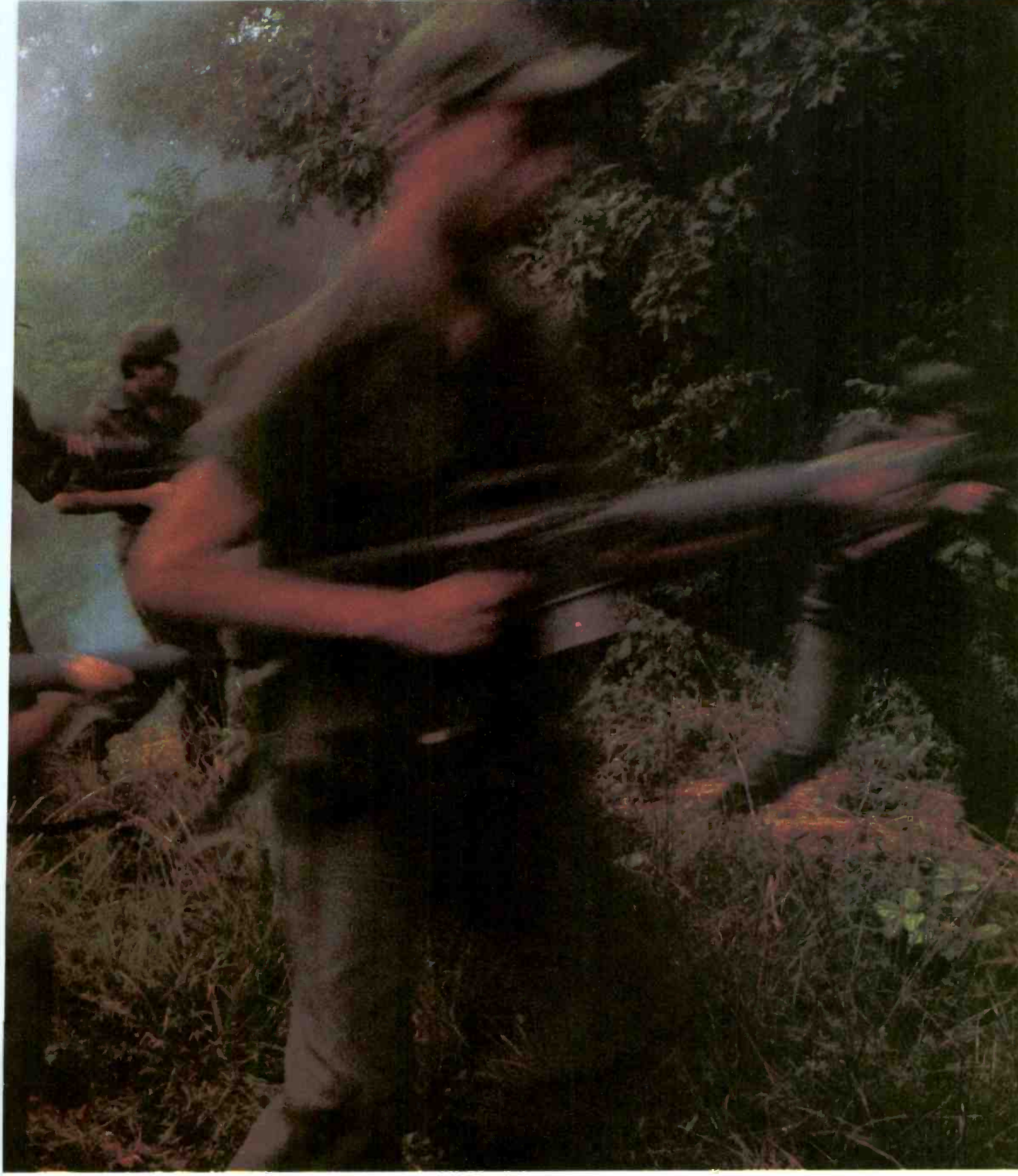

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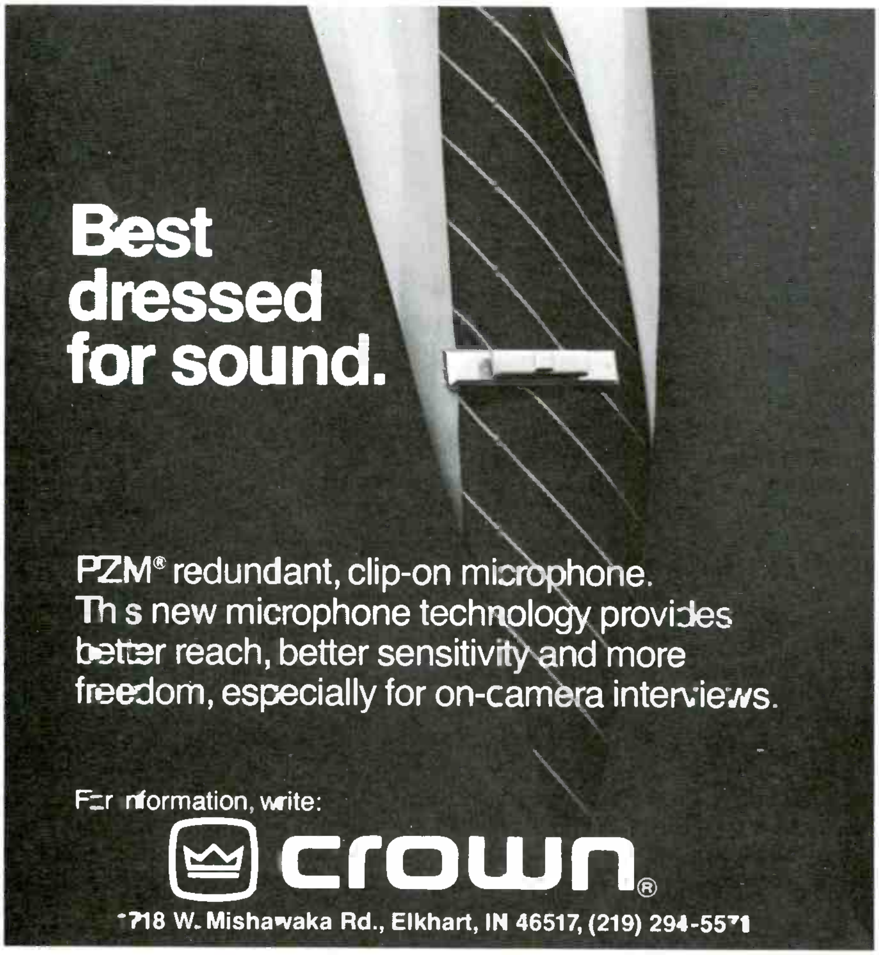

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Continued from page 118

several years ago, they were greeted with open arms because of the enormous decrease in the complexity of the overall transmitting equipment that was realized. Coupled with IF modulation, it was possible to eliminate outboard vestigial sideband filters and all necessary circuitry and paraphernalia required for modulation at high levels. The very high gain and high power output quality of these klystrons was considered to be a major advancement in the state-of-the-art for UHF transmitters.

The klystron amplifiers still represent the most desirable way to operate high power UHF transmitters at the present time. However, the poor efficiency of these amplifiers *could* be improved and brought closer to the efficiency of VHF amplifiers. A number of techniques have been developed starting with the anode pulsar used to decrease the anode current in the klystron during those periods of the TV waveform when full output power is not required. That is, the klystron current was increased to the larger value during sync pulses when it was necessary to develop peak output power, and then reduced during those periods of video content when a lower power output was acceptable.

The use of the anode pulsar still did not bring the efficiency of the internal cavity klystrons up to the efficiency that was achievable from external cavity klystrons. This *internal vs. external* cavity discussion has continued for the past several years using not only the efficiency argument, but ease of replacement and other parameters that are of interest to broadcasters.

One new development has caused another increase in efficiency of the internal cavity klystrons. This has been the development of an external adjustable output coupler that can be used to optimize the output circuitry of the internal cavity klystron. This topic was discussed by Robert M. Unetich of RCA at NAB-'82/Dallas. He said that an efficiency improvement in the internal cavity klystron of approximately 6% was possible when the coupler was properly adjusted. He also said that it is necessary to adjust this coupler carefully to obtain a reasonable improvement without severe degradation of the output signal quality. It is possible to improve the efficiency to a higher amount if signal quality is allowed to decrease. A reasonable compromise would be necessary for the broadcaster who wished to maintain the signal quality at the state-of-the-art level. Still, the addition of an external coupler to an existing facility is a reasonable approach for a slight efficiency improvement.

Unetich also said that additional compensation networks were necessary in the exciter to reduce the incidental phase modulation in the klystron amplifier when the output coupler was used. In older transmitters that do not have sufficient capabilities to reduce this phase modulation, only about 3% improvement in efficiency would be realized.

The second speaker at that seminar, Robert S. Symons of Varian Associates, discussed a possible change in klystrons, the design of depressed collector klystrons. These klystrons possess the capability for approximately 56% average theoretical efficiency. However, Symons said that this is not realizable in practice. What is being sought in the klystron design is a way to make a significant improvement in the efficiency. Adding 1% or 2% is nice, but a real improvement of about 20% to 30% would be necessary to bring UHF transmitters into line with VHF. The depressed collector concept being evaluated by Varian and other klystron manufacturers may some day lead to a significant improvement in efficiency at 55kW and higher power levels.

The final speaker at the seminar, who discussed the actual transmitters, was Heinz Bohlen of Valvo-Philips. Bohlen discussed a modulated grid klystron that is available from Philips for use at the 55kW power level. This klystron uses an *annular* electrode to control the beam current. The video signal is applied to this annular electrode after having passed through a bandpass filter that limits the frequency of the video signal to that portion where double sideband operation is acceptable by the FCC. This signal is then applied to the annular electrode to vary the beam current in the klystron in accordance with the actual level of the incoming signal. A second signal is applied to the klystron in a conventional manner that possesses full bandwidth and contains all necessary corrections to compensate for the non-linearities of the klystron amplifier. This operation results in an efficiency improvement of 20% to 30% over the external cavity klystron operating in the normal mode. The overall efficiency of the final amplifier klystron operated in this fashion is between 60% and 70%. This is a significant step in the state-of-the-art.

Symons said in his paper that the UHF broadcast industry currently spends approximately $22 million a year for electrical power to operate its transmitters. If the industry were to convert all the existing UHF transmitters to beam-controlled klystron systems, the power bill would be reduced to about $12 to $14 million.

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However, that's the good news; the bad news is that not all transmitters will be capable of being converted simply. It may be necessary to install a new exciter or to modify the existing exciter to provide the necessary compensation circuitry. Also, the modulating section that provides the control voltage to the control electrode in the klystron will have to be added. If the broadcaster is currently using an integral cavity klystron amplifier, a change will have to be made to an external cavity klystron.

There are other advantages that may offset some of this cost. The price of the beam-controlled klystron is approximately the same as the existing external cavity klystrons. It seems that the life of these klystrons may be longer than the life of the existing klystrons, because the beam current necessary for the same power output is somewhat reduced. Also, the heat load that is seen by the cooling system for the klystron is greatly reduced. Furthermore, the load on the transmitter power supply will be reduced, which may result in longer life for existing equipment or in smaller required capacity for future systems.

One additional speaker at the NAB seminar on transmitter efficiency was Thomas J. Vaughan of Micro Communications. Vaughan discussed the possible efficiency improvement gained by changing from coaxial transmission line to circular waveguide. His company manufactures this waveguide and has installed it on several towers. The technical aspects of circular waveguide usage or design will be covered in a separate article to be published later, but it is significant to note that substantial power savings can be realized by use of circular waveguide instead of conventional coaxial cable. This results in power savings to the operator in a facility that is operating at 5MW effective radiated power.

If the station is not operating at the maximum limit permitted by law, the savings in power consumption probably will not be realized, but an alternative advantage of obtaining a higher effective radiated power for the same transmitter output would be just as desirable. Vaughan presented figures demonstrating that a station with a 2000-foot tower operating at 220kW transmitter output to obtain 5MW effective radiated power would save approximately $37,000 per year using

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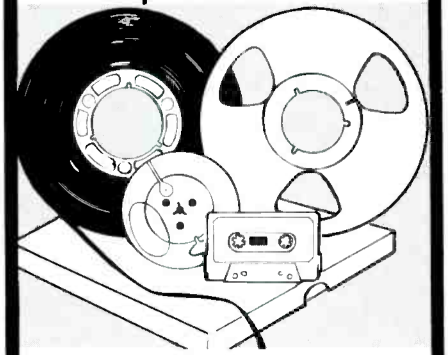

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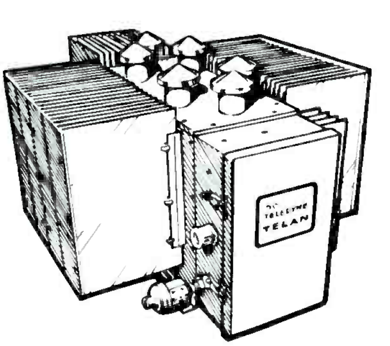

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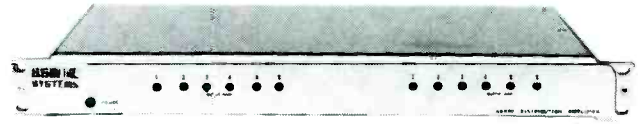

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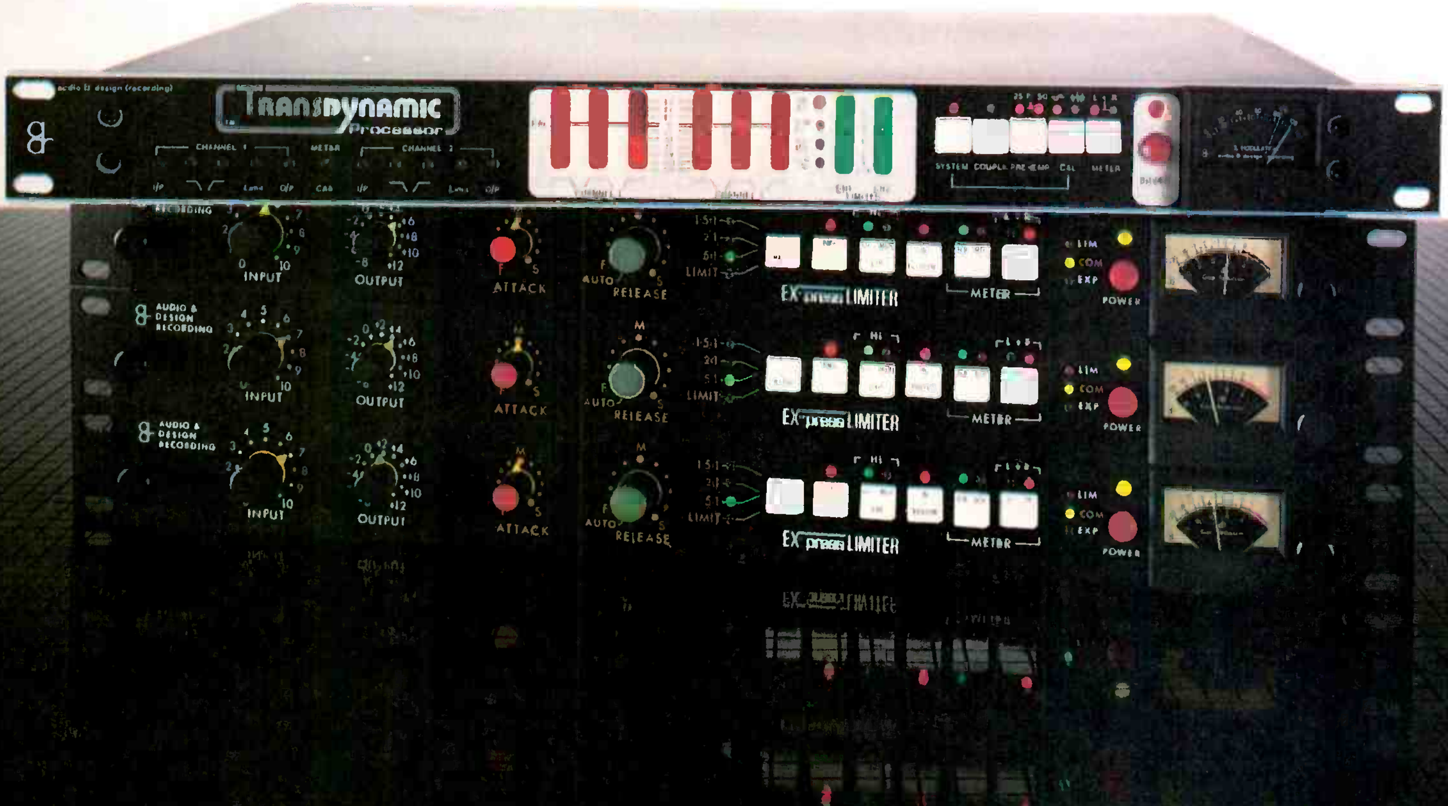
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circular waveguide on Channel 20, compared to the use of 8-3/16-inch coaxial cable. On Channel 50, the loss in the coaxial cable increases so that the power savings using circular waveguide would be in excess of $50,000 annually. It should be recognized that the power being saved by lowered attenuation in the waveguide is real RF power and is considerably more expensive in terms of kilowatt cost than the power from the utility company.

It would seem that the conversion of all existing UHF transmitters to beam-controlled klystron systems, and of all high power UHF stations with towers of 1000 feet or more to circular waveguide, while at the same time holding the effective radiated power at the same level, would result in approximately 50% savings from the utility bill for the UHF industry. This is an idealized concept and not a goal obtainable in the next calendar year. However, it can certainly be anticipated that over the next 10 years, the emphasis on improved transmitter efficiency will continue and that the state-of-the-art will consistently improve toward that goal. Basic research has always been stimulated by the demands of the marketplace. As the UHF broadcaster sees his power bill increase, he will push even harder on his technical director to seek a means of lowering that expense. His technical director, in turn, is going to push the manufacturers to improve their products. The natural actions of the marketplace are probably going to dictate that the most *efficient* transmitter will become the most *popular* transmitter, if the price and signal quality stay nearly equal to those of other manufacturers' products.

It is not the purpose of this article to claim that the beam-controlled klystron is necessarily the answer to all efficiency problems. Other manufacturers are working on devices that will improve amplifier efficiency at these power levels in the UHF spectrum. Even the old *tried and true* tetrode is being re-evaluated and modified, looking toward use in UHF high power transmitters. It is possible that more than one device will emerge from this development process and be capable of providing 70% to 80% efficiency in UHF transmitters. It seems at this point that the beam-controlled klystron will be one of those devices and, as such, is a welcome addition to our industry.

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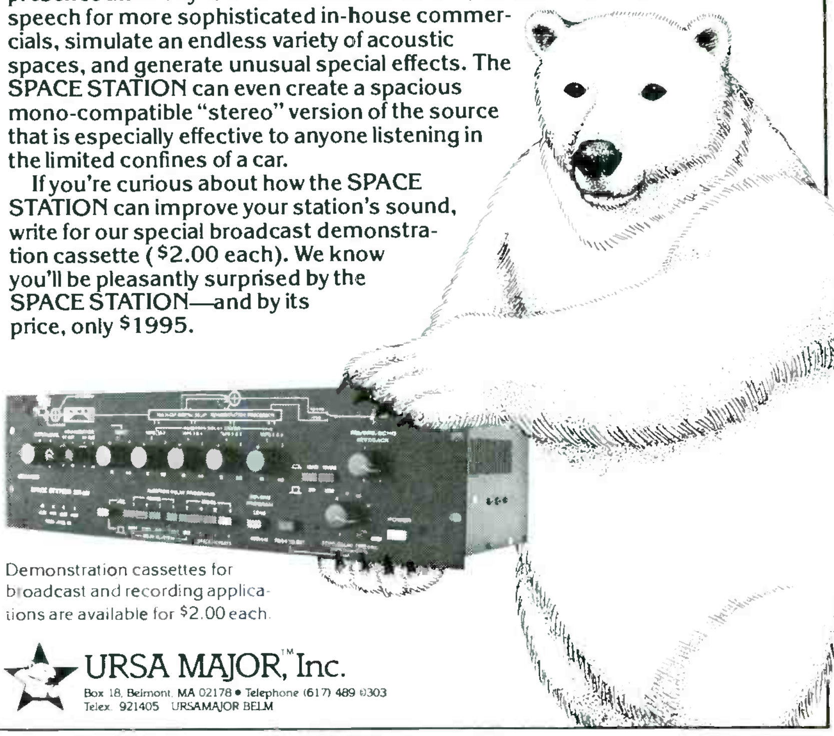

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The 72nd Annual Audio Engineering Society Convention will be held at the Disneyland Hotel in Anaheim, CA. Technical papers and exhibits will be featured at this convention, whose theme is "Audio in a Changing World." On Sept. 23, there will be no workshops or seminars. The exhibit hall *will* be open, however. For more information, contact AES at 60 E. 42nd St., Room 2520, New York, NY 10165; 1-212-661-8528 or 1-212-661-2355.

Oct. 26-28

The Third Annual Visual Communications Congress/West will be held at the Century Plaza Hotel in Los Angeles. Topics will include interactive video, videotex, teleconferencing and videodiscs. Seminars deal with film and TV production, photography and audio-visual presentations. Concurrent meetings will be held by the International Television Association, the Information Film Producers of America, the Health Education Media Association, and the Association of Audio-Visual Technicians. For more program information, contact the VCC Conference Management Corporation, 17 Washington St., Norwalk, CT 06854; 1-203-852-0500.

Nov. 1-3

Atlanta's Marriott Hotel is the site of the *Eighth Annual Satellite Communications Symposium*. Sponsored by Scientific-Atlanta, the symposium will feature panel discussions led by SA personnel and outside industry leaders. Topics will include programming by satellite, teleconferencing, high speed digital transmission and earth station design. A technical book will be furnished to attendees. For more information, contact Scientific-Atlanta, 3845 Pleasantdale Road, Atlanta, GA 30340; 1-404-449-2000.

Nov. 7-10

The 1982 National Telesystems Conference, "Systems for the Eighties," will be held in Galveston, TX. The conference's technical program will focus on systems for telecommunications, radar, navigation and remote sensing. For more information, contact Dr. B.H. Batson, general chairman, Johnson Space Center (EE8), Houston, TX 77058; 1-713-483-4647.

Nov. 7-12

The 124th SMPTE Technical Conference and Equipment Exhibit will be held at the New York Hilton Hotel. The conference will have five days of sessions on the technical aspects of motion pictures and television. Also, there will be a 300-booth exhibit featuring the latest motion picture and TV equipment. More information on the conference is available from SMPTE, 862 Scarsdale Ave., Scarsdale, NY 10583; 1-914-472-6606.

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No blue tint or edging—all hair detail intact!*

These same results are possible in **your** newscasts and other live broadcast situations. Operating on a new principle, detail from the foreground camera comes through perfectly in the composite—including each strand of hair, smoke, liquid, shadows, transparent objects—the works! No blue tint, blue edging or edge crawl—no "cut-out" look; no soft edges on hard objects—no hard edges on soft objects.

NEWSMATTE needs no encoder and is simple to operate with its one knob control. It will integrate into your switcher or can stand alone. **NEWSMATTE** marks a breakthrough for live broadcast just as the Emmy award winning **ULTIMATTE-4** was a breakthrough for commercials and TV production. Call or write **now** for more information or a demonstration.

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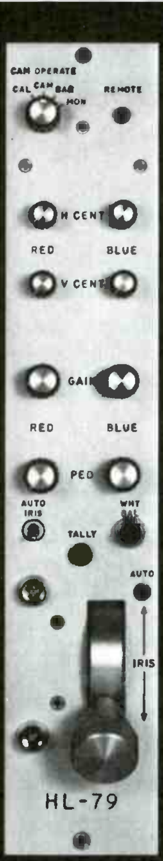
FIVE PROBLEM SOLVERS FROM AFA!

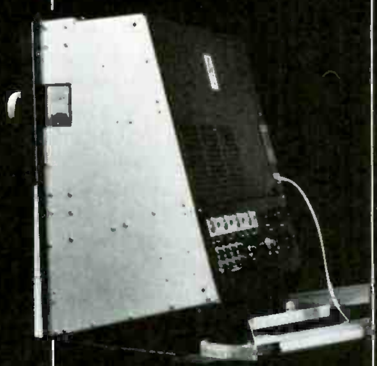
Here are five no-nonsense products that have been developed by A.F. Associates in direct response to requests from broadcast and cable engineers across the country:



CAMERA CONTROL PANEL

SLATE CAMERA

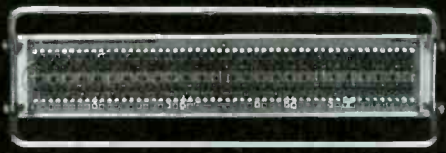
RACK MOUNTED VTR (FRONT VIEW)



RACK MOUNTED VTR (VIEW OF EXTENDER UNIT)

MONITORING UNIT

PATCHFIELD PANEL (FRONT VIEW)



PATCHFIELD PANEL (REAR VIEW)

1. AFA JOY STICK CAMERA CONTROL PANEL (RCC-200 Series)
   Provides mobile and studio operations with a fast, simple method of controlling camera shadings.
2. AFA SLATE CAMERA SYSTEM (SC-300)
   A compact, self-contained title card camera for mobile and studio operations.
3. MARCONI VIDEOTAPE MONITORING UNIT
   Provides monitoring selection and TBC controls in a single unit.
4. AFA RICK RACK EXTENDER UNIT
   Provides a friction-controlled turntable that facilitates servicing of Ampex VPR2 & VPR2B and Marconi MR2 & MR2B VTRs when rack mounted.
5. AFA AUDIO PATCHFIELD
   Precision engineered audio patch panel.

For more information on specifications, costs and delivery, contact Richard Lunniss in New Jersey (201) 767-1000 or Noel Parente in California (213) 466-5066. Check them out, today!

AFA

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BROADCAST
engineering

1982
Buyers' Guide

630 product categories and more than 850 listed manufacturers are featured in our most comprehensive guide yet

- *Product Directory* section begins on page 130.
- *Broadcast Product Manufacturers' Addresses* section begins on page 188.
- *Broadcast Product Dealer/Distributors* section begins on page 211.

Since our first edition of the *Buyers' Guide* 14 years ago, the broadcasting industry has grown tremendously in complexity of equipment and completeness of broadcast services. Just as the industry has responded to the use of new technologies—most notably the microprocessor, in all phases of automation—the *Buyers' Guide* has responded by providing the most complete directory possible for engineers, managers and purchasing agents requiring broadcasting equipment or services. Reflecting the current healthy state of our industry, this year's *Buyers' Guide* features 630 product categories, lists more than 850 manufacturers, and contains more than 300 advertisers. It is the result of a dedicated staff effort to make it our finest tool for purchasing the industry's hardware, software and services.

Each year, **Broadcast Engineering** mails extensive questionnaire forms to suppliers around the world. They are asked to identify, by special code number, every product they currently market. In the process, scores of new products and companies are added, while lines that have been phased out—and companies that have left the field—are deleted. Once amassed and assembled, these new data are processed through a unique computer operation, programmed to "read" the code numbers and assign company names and *Red Listings* to appropriate product headings.

Advertisers are listed in red in the *Product Directory.* These *Red Listings* include the ad page location to serve as a direct reference to the product information you are seeking.

Broadcast product manufacturers' addresses are featured beginning on page 188. In this section, you will find a complete, alphabetized index of mailing addresses for all of the companies listed in the *Product Directory*. Additional information appears in the index listing for advertisers in this issue: the name and telephone number of the home office sales manager, followed by, in many cases, a roster of regional sales contacts for that company.

Broadcast product dealer/distributors are listed separately in the section beginning on page 211, followed by the states they serve and the products/services they provide. Ads for dealer/distributors in this issue appear either on the page of each company's listing or on the facing page. A complete explanation of this section appears on page 211.

Reader service cards are bound into this edition for your convenience. Each card is valid for one year. By circling the appropriate numbers on the card, you can secure information directly from the advertiser through August 1983.

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Airborne Communications Equipment

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Audisar
Calzone Case Co.
Commerce Airborne Div. IFR Avionics, Inc.
ComWorld Video Services
Datum Inc.
ENG Helicopter Satellites, Ltd.
The Enstrom Helicopter Corp.
Feathercam Inc.
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Potomac Instruments, Inc.
Telcom Research

Alarms, Fault

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Bird Electronic Corp.
Coastcom
Communitronics Ltd.
High Country Engineering
Hughey & Phillips Inc.
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Datatronix, Inc.
Datum Inc.
DYMA Engineering, Inc.
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Excalibur Electronics, Inc.
Fisher Berkeley Corp.
Hammond Industries Inc.
High Country Engineering
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International Nuclear Corp.
Ivie Electronics, Inc.
Johnson Electronics Inc.
Larus Corp.
Link Electronics Ltd.
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Kahn Communications, Inc.
LPB Inc.
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Modular Audio Products Unit of Modular Devices, Inc.
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Broadcast Electronics, Inc.
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Ivie Electronics, Inc.
McMartin Industries, Inc.
Micro-Trak Corp.
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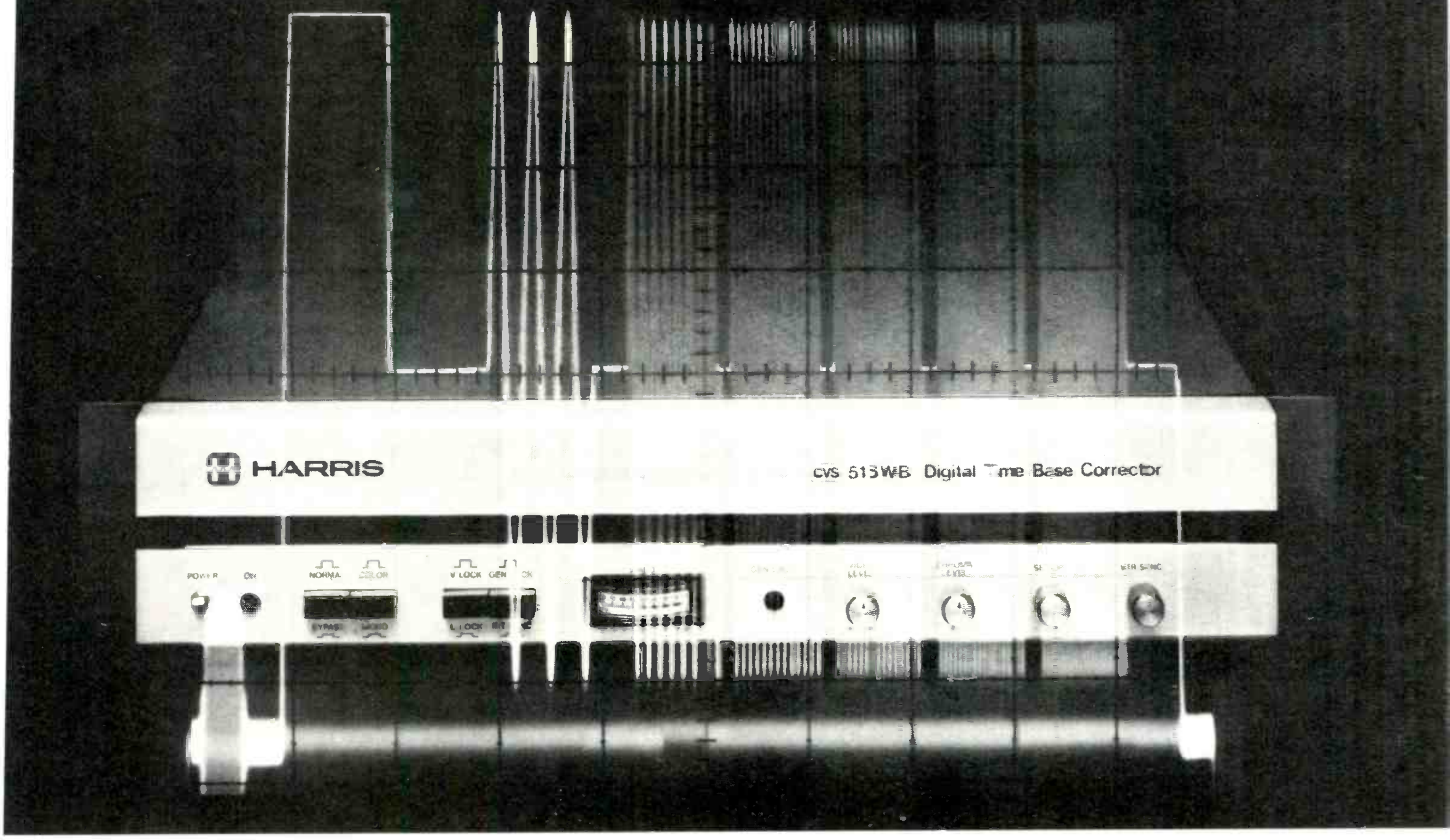
ProTech Audio Corp.
Richmond Sound Design, Ltd.

Broadcast Product Manufacturers' Addresses begin on page 188

The Transparent TBC

All the bandwidth you need for the new VTRs



Now there's a digital TBC that handles the extended frequency response of the new helical VTRs — without the hassle of 3.58 MHz feedback.

The CVS 516WB has all the features of our CVS 516 — an industry standard for non-segmented heterodyne VTRs — plus new circuitry for virtually transparent performance.

With the CVS 516WB, users of the new generation VTRs, like the Sony BVU-800, the Sony 5850 and the JVC 8500, are free of TBC-imposed limitations on resolution performance, and the "soft" look of yesterday's TBCs.

In addition, standard features of the CVS 516WB include a 16 line window, with Gyrocomp, to correct your worst tapes. And, for better editing, Automatic Vertical Centering eliminates sync reset and throughput delay ambiguity.

The CVS 516WB also features a DOC and chroma noise reduction. Plus a broadcast stable, gen-lock sync generator and a full proc amp with preset level controls.

For details about, and a demonstration of, this new generation TBC, contact your Authorized HVS Distributor, or HVS, today. Be sure to ask for our popular booklet about the advantages of digital time base correction when you call or write: Harris Corporation, Harris Video Systems, 1255 East Arques Avenue, Sunnyvale, CA 94086 (408) 737-2100.

HARRIS

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Audisar
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Blonder-Tongue Lab., Inc.
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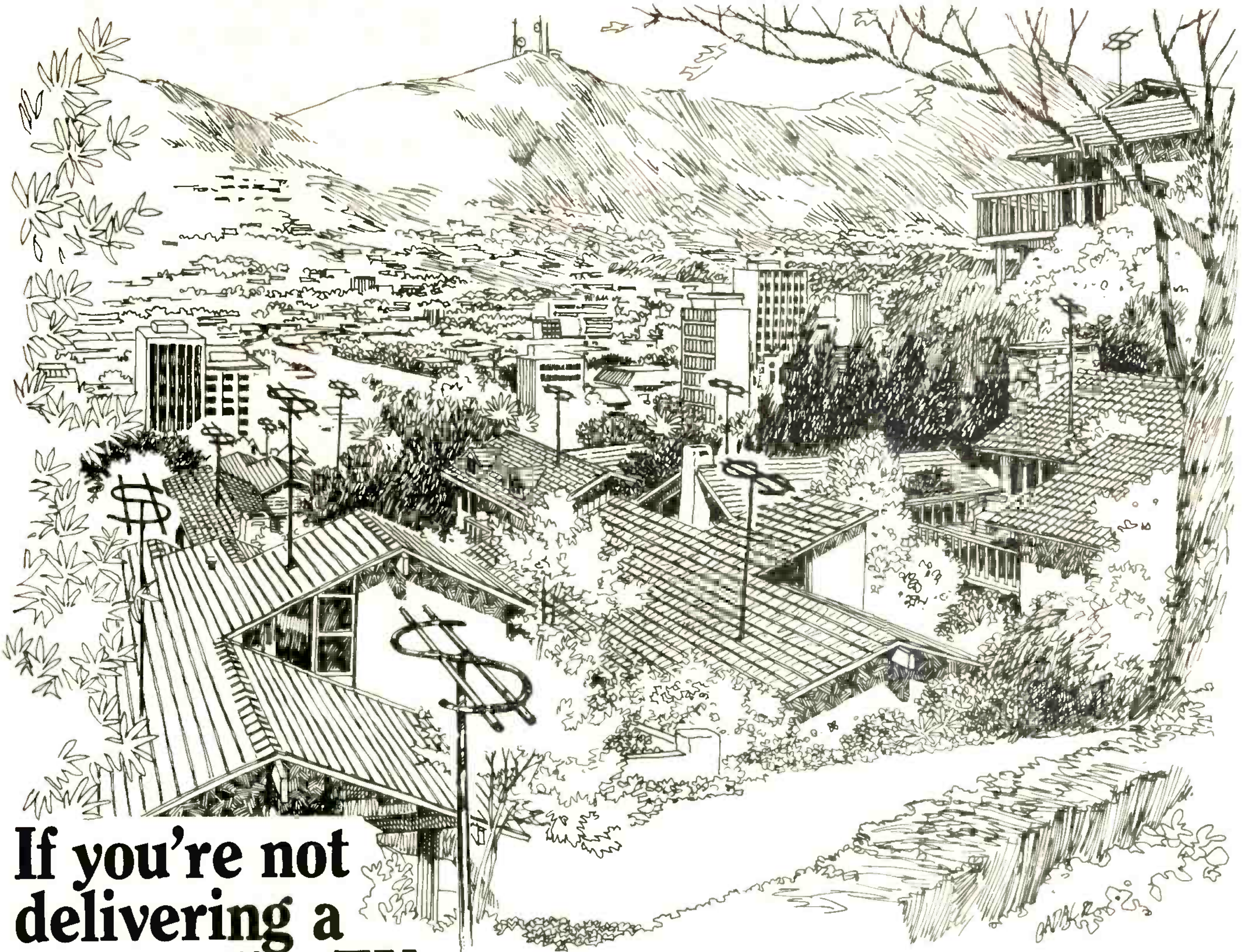

If you're not delivering a top-quality TV signal into every corner of your service area, you could be missing the picture.

CETEC CP/TV ANTENNAS PAY HANDSOME DIVIDENDS WHERE IT COUNTS: MARKET SHARE. By now there shouldn't be any argument about the superiority of CP/TV. In less than three years, nearly 100 stations have quietly converted their horizontal signals to CP. That's important to tens of millions of Americans who were receiving a second or third-rate TV picture. It's a critical fact-of-life to the broadcaster who recognizes the competitive advantages to delivering the highest quality video signal in his market. To all of his market.

IN CP/TV, CETEC IS THE LEADER. Nearly a decade has passed in the refinement of CP technology. Cetec Antennas has clearly become the recognized leader in this refinement.

- Starting in 1973, we pioneered the design in CP/TV.
- Cetec's first Spiral design was on-the-air in 1976.
- A Cetec CP/TV Spiral recently went on-the-air at superstation WLS-TV.

And there's three patents that are licensed to us from the world-renowned authority on CP/TV antenna design—Dr. Raymond DuHamel.

From channel 2 through 70, Cetec Antennas is the only company that covers the entire VHF/UHF spectrum in one design.

IN CP/TV, CETEC'S NUMBERS MEAN AUDIENCE NUMBERS. Cetec's patented Spiral CP/TV antenna has a proven axial ratio: less than 2 dB; and real azimuth circularity: less than 1.5 dB.

If you haven't got the lowest axial ratio, you've missed the whole point of CP. These numbers mean that your numbers will be better in the cities where buildings cause interference and ghosting, and in the hilly and mountainous areas where there are pockets of weak reception.

IN CP/TV, WE DELIVER—FAST. We deliver our CP/TV antennas, customized for any service area, in about 150 days. That includes full-scale testing. By a wide margin, that's the shortest lead-time in the industry We guarantee competitive pricing for a true CP/TV antenna, and we back every one with the best warranty—two full years, parts and labor.

GET THE PICTURE? Get Cetec Antennas' experience in design and manufacture of CP/TV. You could be missing the picture if you're not delivering the best reception to every corner of your service area. It's more than a fringe benefit that's involved. It's a downright smart investment that will payoff handsomely to the broadcaster who sees more than just antennas in the sky.

For full technical and financial information contact our exclusive CP/TV engineering sales representatives:

Broadcast Systems, Inc.
8222 Jamestown Drive
Austin, Texas 78758
(800) 531-5232

Cetec Antennas *The Edge In Coverage!*
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Electro-Acoustic Designs, Inc.
Fort Worth Tower Co.
Gabriel Electronics, Inc.
H & R Communications
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Harris Corp. Broadcast Microwave
Harris Corp. Satellite Communications Div.
Hughes Aircraft Co. Microwave Communications Products
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Modulation Associates Inc.
Pinzone Communications Products Inc.
Prodelin Inc.
Radiation Systems, Inc.
SatCom Technologies, Inc. An RSi Co.
The Ken Schaffer Group, Inc.
Scientific-Atlanta, Inc.
Standard Communications Corp.
Townsend Associates, Inc.
United States Tower Co.
Western Tele-Communications, Inc.
Winegard CATV Div.
Wold Communications

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Allen Avionics, Inc.
Altec Lansing Int'l.
Analog Devices, Inc.
Aphex Systems Ltd.
Atlantic Research Corp.
Audio-Technica U.S., Inc.
Auditronics, Inc.
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Datatronix, Inc.
Duncan Electronics, Inc.
DYMA Engineering, Inc.
Excalibur Electronics, Inc.
Gotham Audio Corp.
Kay Elemetrics Corp.
Kings Electronics Co., Inc.
Klark-Teknik Electronics
Larus Corp.
Leader Instruments Corp.
Marconi Instruments Div. of Marconi Electronics Inc.
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ROH Corp.
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Sescom, Inc.
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COMPAC
Electro Impulse, Inc.
Excalibur Electronics, Inc.
Harris Corp. PRD Electronics Div.
Kay Elemetrics Corp.
Kings Electronics Co., Inc.
Larus Corp.
Maury Microwave Corp.
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Texscan Corp.
Trompeter Electronics, Inc.

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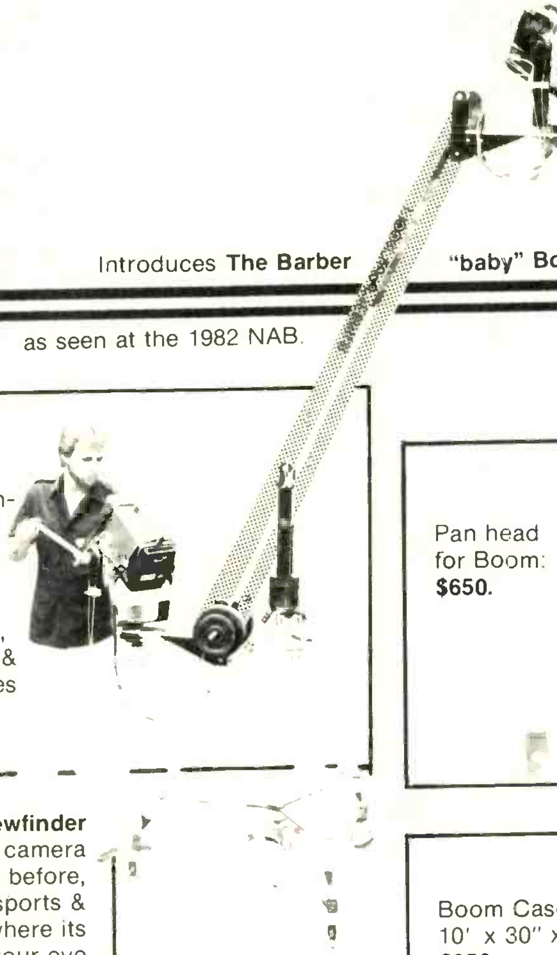

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Finally a practical, inexpensive way to achieve boom shots as never before: ground level to 11'; light weight; fast easy set up; smooth movement of pan, tilt, & boom; remote zoom & focus. See what boom sees on 5" monitor. Already in use at NBC & ABC.

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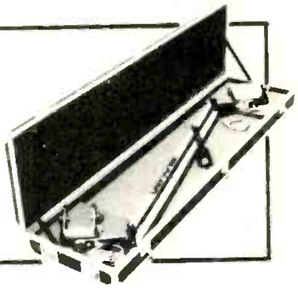

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Now the same people that brought you the **Barber "baby" Boom**, are available for your next production shot. We specialize in the unusual stuff: snow-skiing, ice skating, motorcycle racing, hanggliding, & even horse back riding with the camera, & of course we have a helicopter available. All kinds of moving shots. If no one else will do it call us, **We Love A Challenge**. Call for a demo today: (919) 851-8891.

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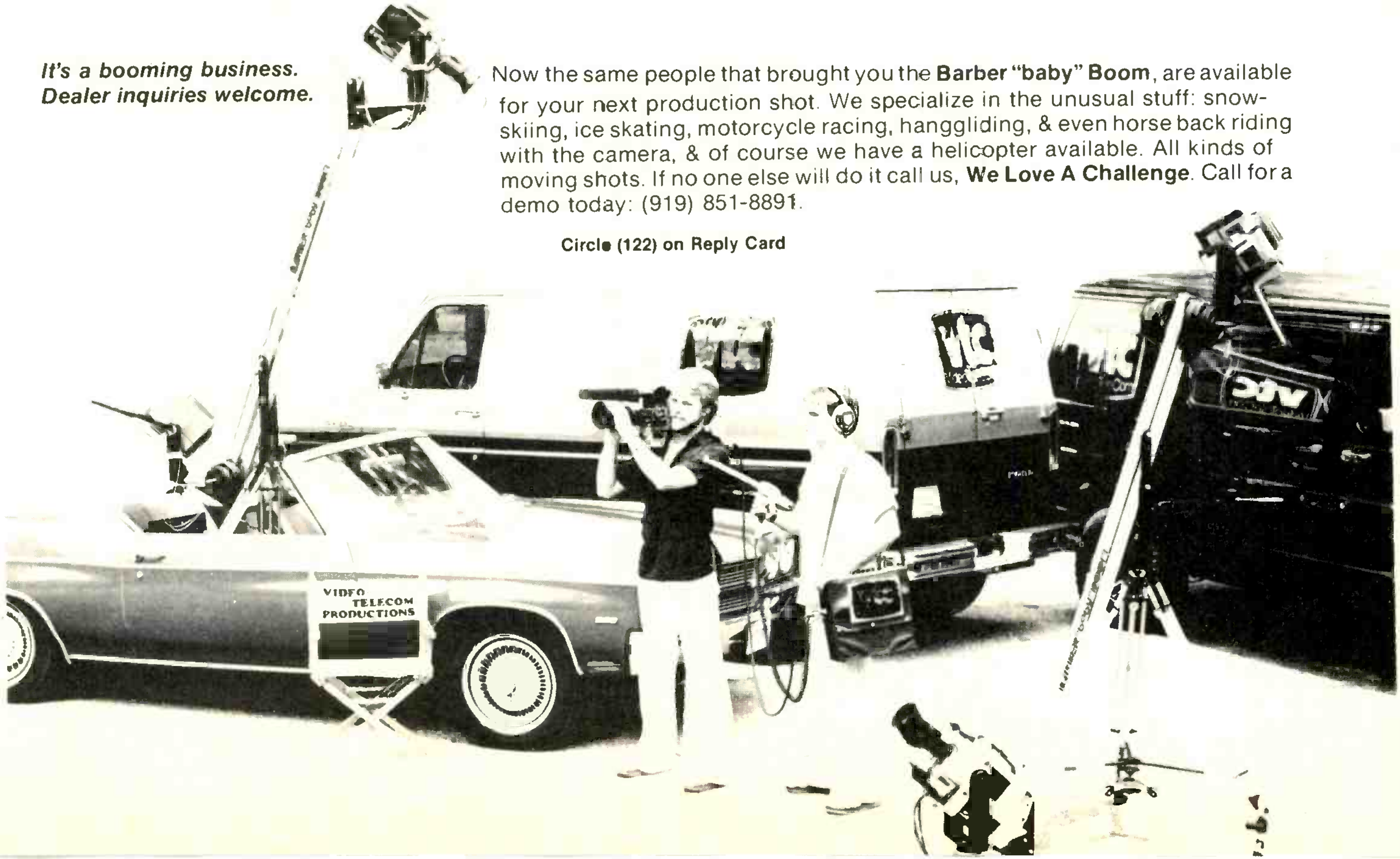

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Audio & Design (Audio & Design Recording, Inc.)
Audio Technology
Audisar
Broadcast Technology, Inc.
ESE
HF Signalling Inc.
Harrison Systems, Inc.
High Country Engineering
Logitek Electronic Systems, Inc.
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Microprobe Electronics, Inc.
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Peters Productions, Inc.
Richmond Sound Design, Ltd.
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Valley People, Inc.

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ProTech Audio Corp.
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Sono-Mag Corp.
Studio Systems Inc.
TFT Inc./Formerly Time & Frequency Technology Inc.
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Colortran, Inc.
Compact Video Sales, Inc.
Design Line Inc.
Dynamic Technology Ltd.
Electro Controls
Electronics Diversified, Inc.
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Kliegl Bros. Lighting
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Quad-Eight Electronics
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Tape-Athon Corp. Cavox Stereo Productions
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UMC Electronics Co. Broadcast Products Div.
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Ward-Beck Systems, Inc.

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Laird Telemedia Inc.
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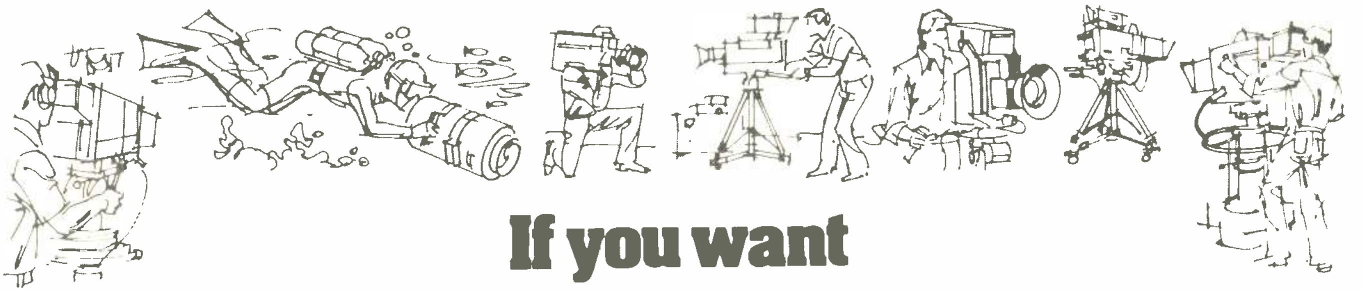
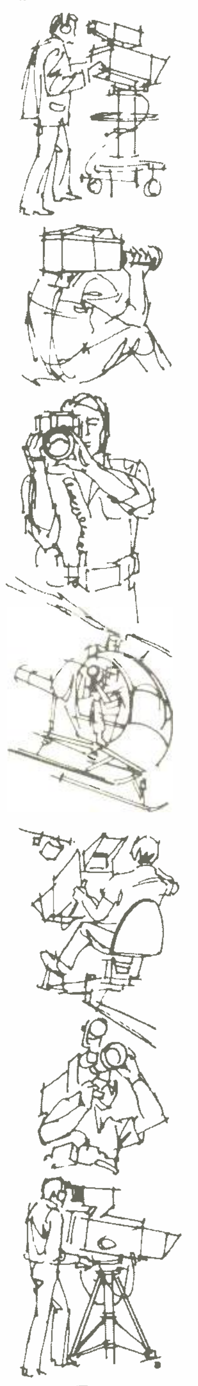
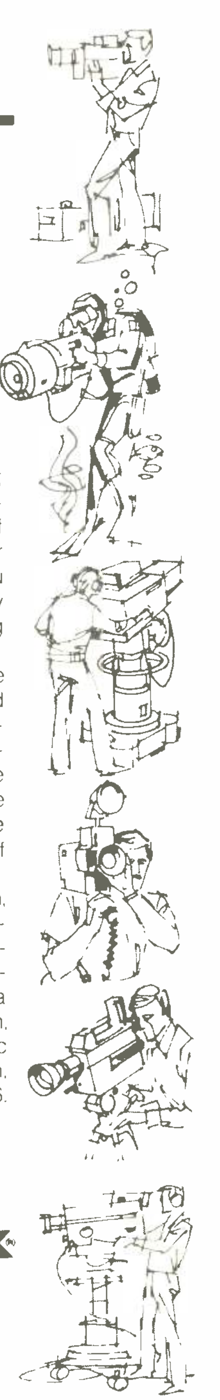
KAVCO, Inc.



If you want Plumbicon* picture quality from your next TV camera buy - **insist** on Plumbicon tubes, because...

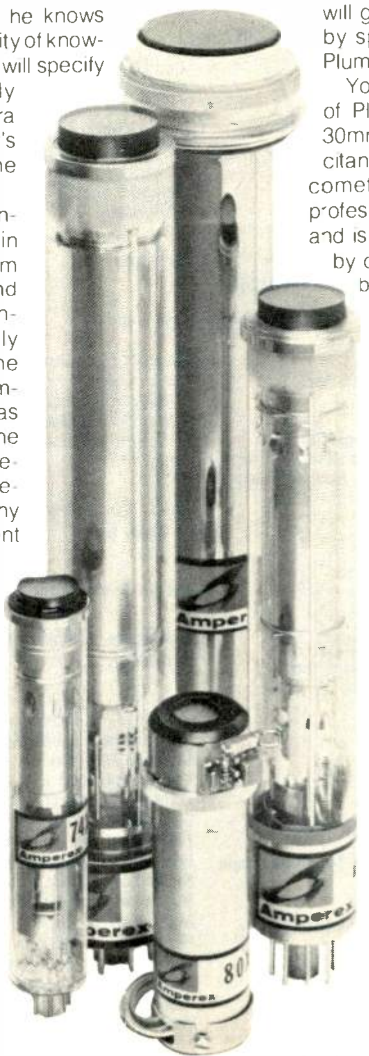




...if it's a professional TV color camera – it's available with Plumbicon tubes.

When you're paying top dollar for a professional TV camera, it is assumed by the manufacturer of the camera that you will specify the pickup tubes for your system. Obviously, the camera manufacturer wants to sell you *his* camera, and since he knows that the overwhelming majority of knowledgeable video purchasers will specify Plumbicon tubes, virtually every professional TV camera system produced for today's market is designed to use the Plumbicon tube.

The crucial factors of sensitivity, resolution and burn-in that affect the "total in-system performance" of ENG and EFP cameras and the consistent record of singularly brilliant performance of the one-inch and the 30mm Plumbicon tubes in studio cameras are generally credited for the professional's continued preference for Plumbicon tube-equipped cameras; that is why an estimated ninety percent of all network color broadcasting originates in Plumbicon pickup tubes.



Whatever your application — ENG, EFP or Studio; whatever the origin of your next camera — American-made or imported; and regardless of the camera salesman's personal persuasion (or his own compensation scheme) — you will get Plumbicon quality pictures only by specifying, insisting, demanding Plumbicon tubes in your camera.

Yours for the specifying, the full line of Plumbicon tubes — ½", ⅔", 1" and 30mm diameters, including low capacitance Diode Gun™ and special anti-comet-tail types — is available in the professional TV camera of your choice and is in demand today as never before by camera users in every segment of broadcast and corporate television.

There is only one Plumbicon, and that famous Emmy-award-winning pickup tube is available for the asking in every three-tube professional TV color camera sold today. For more information, contact: Amperex Electronic Corporation, Slatersville Division, Slatersville, Rhode Island 02876. Telephone: 401-762-3800

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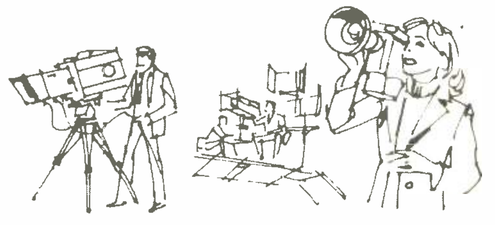

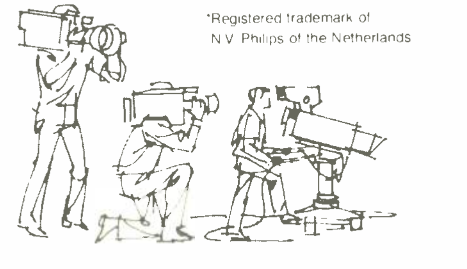

*Registered trademark of N.V. Philips of the Netherlands

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Microprobe Electronics, Inc.
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Sharepoint Systems Inc.
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Telex Communications, Inc.
UMC Electronics Co. Broadcast Products Div.
VIF International
Vital Industries Inc.

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Audio Service Corp.
The BTX Corp.
Broadcast Controls Div. Of Automated Broadcast Controls
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Cetec Broadcast Group
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Design Line Inc.
Dynamic Technology Ltd.
Harris Corp. Broadcast Div.
IGM Communications
Infonics Inc.
Kaman Sciences/KBS
Microprobe Electronics, Inc.
Otari Corp.
ProTech Audio Corp.
Sono-Mag Corp.
Studer Revox America
Tape-Athon Corp. Cavox Stereo Productions
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Leader Instruments Corp.
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Kustom Kraft, Inc.
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B-W Lighting Systems (formerly Panoak Lighting)
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Brabury Group
Bud Industries, Inc.
Calzone Case Co.
Cases Inc.
Cetec Broadcast Group
Comprehensive Video Supply Corp.
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Cosmin Electronics 100
The Drop Shop Ltd.
DYMA Engineering, Inc.
East Coast Sound Inc.
Emcor Products GF Business Equipment, Inc.
Enclosure Corp.
Environmental Container Systems, Inc.
Equipto Electronics Corp.
Equipto
Fiberbilt
GKM Mfg. Corp.
Grumman Aerospace Corp.
Hammond Industries Inc.
Javelin Electronics A Subs. of Kidde, Inc.
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Bayly Engineering Ltd. Member of AEG-Telefunken Group
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Calzone Case Co.
Center Video Center
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East Coast Sound Inc.
Emcor Products GF Business Equipment, Inc.
Environmental Container Systems, Inc.
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Equipto
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The Graphic Express Corp.
Grumman Aerospace Corp.
Hammond Industries Inc.

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Leedal, Inc.
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McCurdy Radio Ind. Inc. .... IBC
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Neumade Industries, Inc.
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IGM Communications
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McCurdy Radio Ind. Inc.
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Telesource Communication Services
Texscan/MSI Corp.
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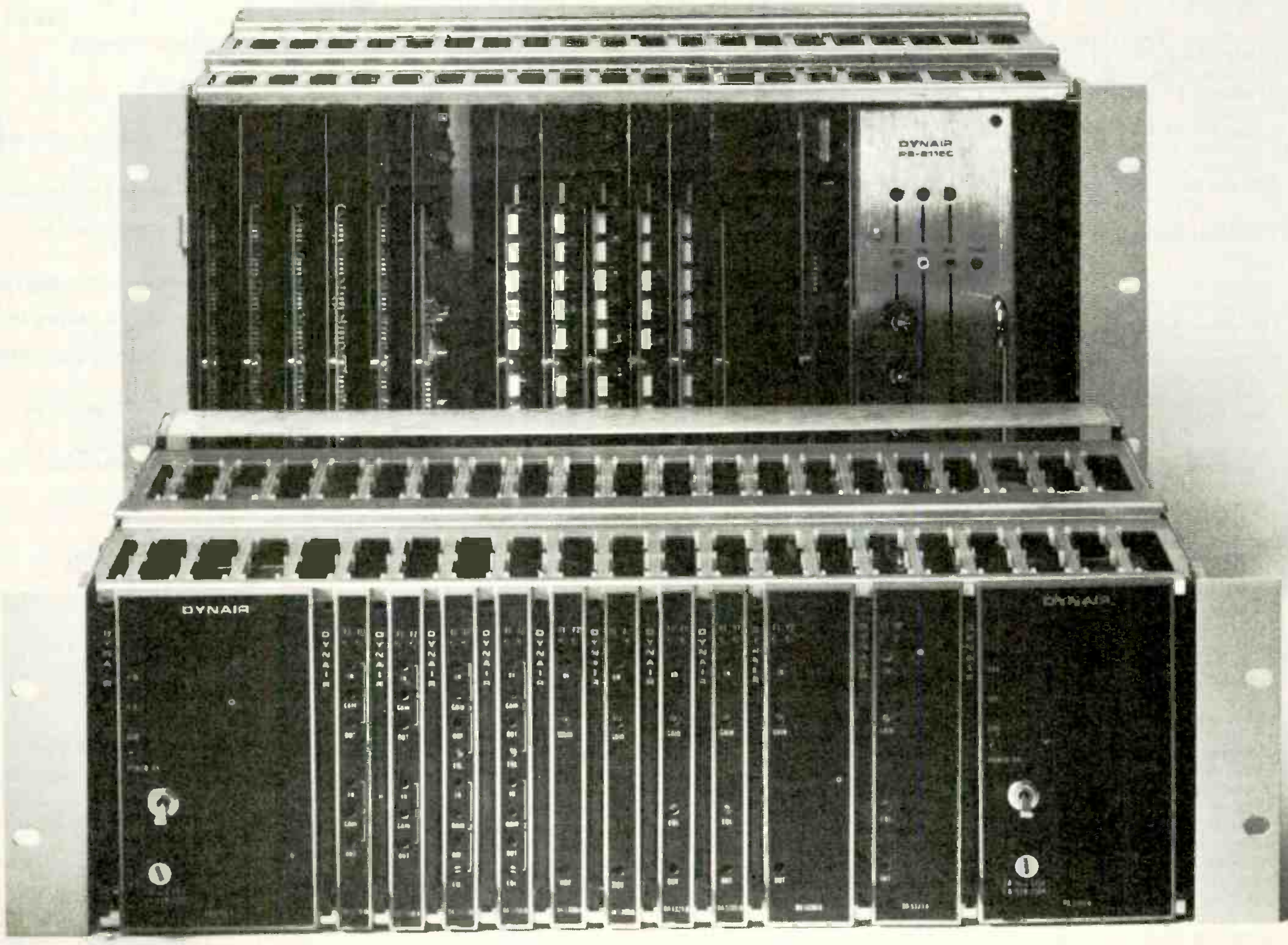

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RCA is now in the FM power tube business with a series of four tubes and cavities designed specifically for high-gain, high-efficiency broadcast service:

Tube Type	Output	Gain	Efficiency	Cavity Model
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8985	25kW	20db	80%	Y1393D-V2
9011	30kW	21db	80%	Y1393D-V3
8984	55kW	16db	78%	Y1369

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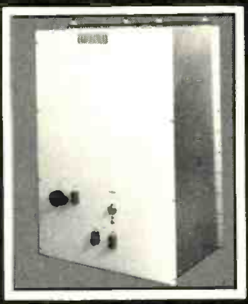
Our cavities complement our tubes. They provide high-gain, grid-driven circuits which take full advantage of the tubes' high Gm electron optics, high efficiency, ease of neutralization and ease of cooling.



We supply both the power tube and the cavity. In our pictured Y1393 cavity, the 9011 tube delivers a measured gain of 20 db with an efficiency of 80%.

Along with our power tubes, and the cavities that bring out their best performance, we also supply service and application engineering. Find out more today. Contact RCA Power Tube Marketing, New Holland Avenue, Lancaster, PA 17604. Call (717) 397-7661. Or get in touch with RCA, Brussels, Belgium. Sao Paulo, Brazil. Sunbury-on-Thames, Middlesex, England. Paris, France. Munich, West Germany. Mexico 16 D.F., Mexico. Hong Kong.

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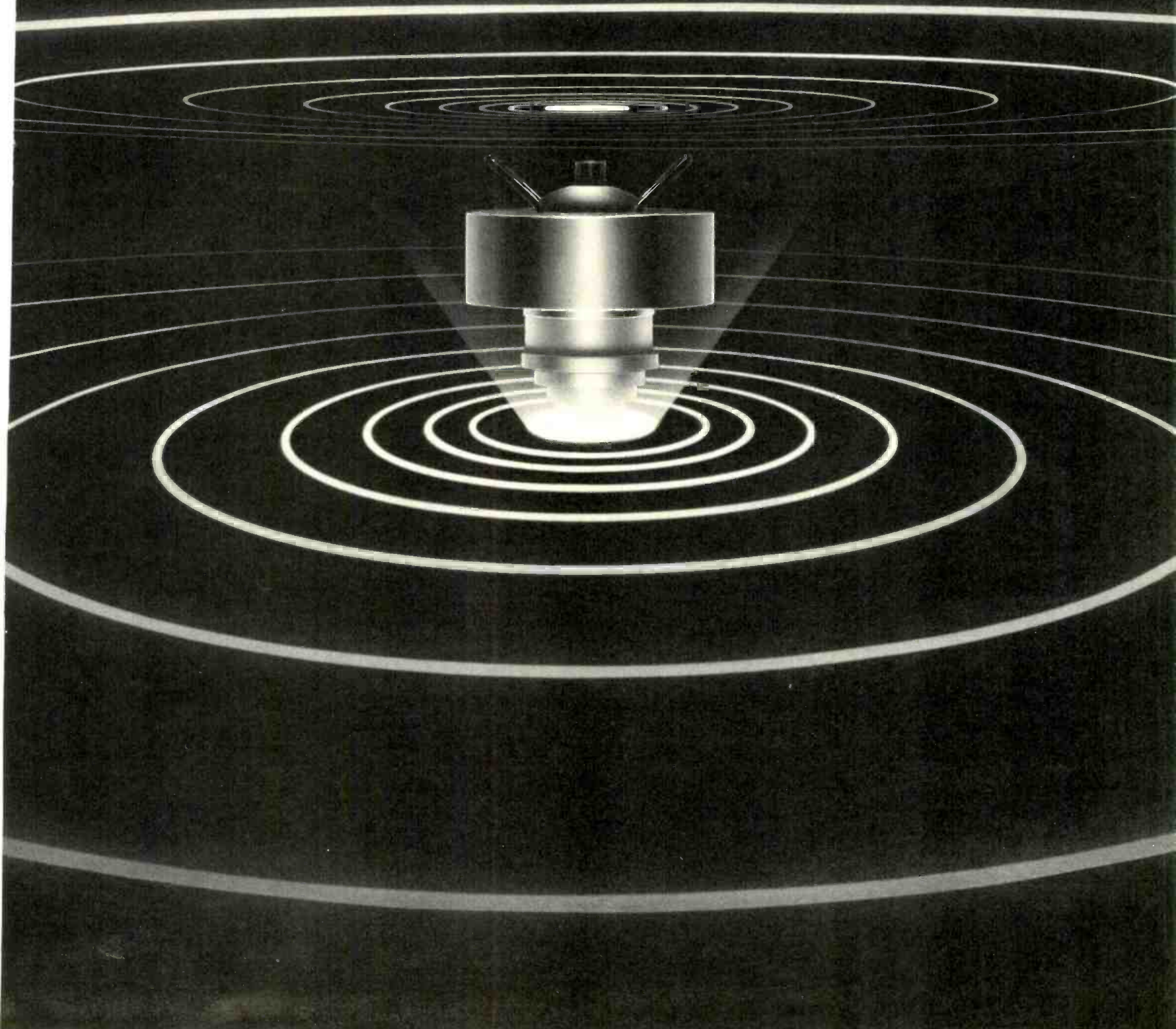

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Comark Industries Inc.
Delta Electronics Inc. (VA)
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Leasametric, Inc.
Maury Microwave Corp.
Micro Communications, Inc.
Moseley Associates, Inc.
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Potomac Instruments, Inc.
Tektronix Inc.
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Television Technology Corp.
Texscan Corp.
Townsend Associates, Inc.
Wide Band Engineering Co., Inc.

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Delta Electronics Inc. (VA)
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Maury Microwave Corp.
Micro Communications, Inc.

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Comark Industries Inc.
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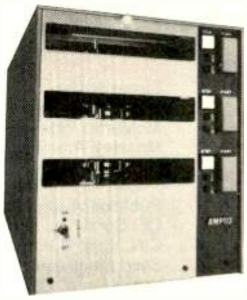

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Acoustilog Inc.
Deltamod Corp.
EXR Corp.
East Coast Sound Inc.
Ramko Research Inc.
Teltone Corp.
URSA MAJOR, Inc.

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Telemet Div. A Geotel, Co.
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Datatronix, Inc.
East Coast Sound Inc.
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Harrison Systems, Inc.
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Avitel Electronics Ltd.
Robert Bosch GmbH
CMC Technology Corp.
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Datatek Corp.
Di-Tech Inc.
Dynair Electronics, Inc.
ESC Electronics Corp.
Electrocraft Consultants Ltd.
Graham-Patten Systems, Inc.
Grass Valley Group, Inc.
Industrial Sciences, Inc. (ISI)
International Nuclear Corp.
Kappa Networks, Inc.
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Sigma Electronics, Inc.
Telemet Div. A Geotel, Co.

Equipment Reconditioning and Rebuilding

Acoustilog Inc.
B-W Lighting Systems (formerly Panoak Lighting)
CSP Inc.
Century 21 Programming Inc.
DYMA Engineering, Inc.
Processing Plus, Inc.

Equipment, Used and Reconditioned

A. F. Associates, Inc.
Acoustilog Inc.
Ampex Corp.
Audiotechniques Inc.
Center Video Center
Century 21 Programming Inc.
East Coast Sound Inc.
Harris Corp. Broadcast Div.
Leasametric, Inc.
Microtime, Inc.
Microwave Assoc. Communications
Old Dominion Broadcast Eng. Service
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Townsend Associates, Inc.

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Micro Control Associates, Inc.
NEC America, Inc. Broadcast Equip. Div.
Publison Audio Professional
QEI Corp.
RCA Broadcast Systems
Rohde & Schwarz Sales Co.
C.N. Rood B.V.
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Dilor Industries Ltd.
Duncan Electronics, Inc.
Electro Controls
Electronics Diversified, Inc.
Kliegl Bros. Lighting
Olesen
Packaged Lighting Systems
Skirpan Lighting Systems, Inc.
Strand Century, Inc.
Theatre Techniques Inc.
Theatrical Services Inc.
Waters Mfg. Inc.

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Anaconda-Ericsson Corp.
Andrew Corp.
Artel Communications Corp.

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Robert Bosch GmbH
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E. I. du Pont de Nemours & Co., Inc. Product Information
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Industrial Sciences, Inc. (ISI)
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Marconi Communication Systems Ltd.
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Multi-Track Magnetics, Inc.
Panasonic Company
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RCA Broadcast Systems
Radmar, Inc.
Rank Cintel
Rank Precision Industries Inc.
Sony Corp. of America
The Zei-Mark Corp.

Film Inspection and Cleaning Equipment

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The Durafilm Co.
Kinetronics Corp.
Lipsner-Smith Co.
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Piclear, Inc.
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Acoustilog Inc.
Allen Avionics, Inc.
Altec Lansing Int'l.
Amber Electro Design, Ltd.
Amek Systems & Controls Ltd.
Aphex Systems Ltd.
Ashly Audio
Audico, Inc.
Audio & Design (Audio & Design Recording, Inc.)
Audisar
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Broadcast Controls Div. Of Automated Broadcast Controls
Coastcom
Coherent Communications
Comark Industries Inc.
Crown International, Inc.
Datatronix, Inc.
DYMA Engineering, Inc.
EMT-FRANZ GMBH
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Furman Sound, Inc.
Gotham Audio Corp.
Inovonics Inc.
Ivie Electronics, Inc.
Kappa Networks, Inc.
Micro-Trak Corp.
Modulation Associates Inc.
Monroe Electronics, Inc.
Rupert Neve, Inc.
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ProTech Audio Corp.
Publison Audio Professional
QEI Corp.
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Audisar
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3CX1000A7	500.00
3CX1500A7	460.00
3CX2500A3	426.00
3CX2500F3	415.00
3CX3000A1	420.00
3CX3000A7	540.00
3CX3000F1	495.00
3CX3000F7	602.00
3CX10000A3	1062.00
3CX10000A7	1420.00
3CX15000A3	1350.00
3CX15000A7	1330.00
3CX20000A7	1855.00
3-400Z	82.00
3-500Z	88.00
4CV35000A	2165.00
4CX250B	55.00
4CX250BC	68.00
4CX250K	120.00
4CX250R	87.00
4CX300A	175.00
4CX350A	105.00
4CX350F	118.00
4CX1000A	365.00
4CX1000K	450.00
4CX1500A	579.00
4CX1500B	460.00
4CX3000A	862.00
4CX5000A	1018.00
4CX10000D	1175.00
4CX15000A	1400.00
4CX20000A	1475.00
4CX35000C	5520.00
4CX40000G	6722.00
4X150A	49.50
4X500A	320.00
4-65A	62.00
4-125A	70.00
4-250A	90.00
4-400A C	88.00
4-400AX	160.00
4-400B	110.00
4-500A	192.00
4-1000A	415.00
5CX1500A	620.00

TRANSMITTING TUBES

Tube	Price
5-500A	225.00
575A	27.00
673.0u	35.00
802	27.50
805	50.00
807	5.50
810	60.00
813	40.00
816	5.25
828	80.00
833A	80.00
866A	6.80
872A	15.50
889RA	1775.00
891R	2220.00
892R	2200.00
4055V I	105.00
5762	910.00
5879	4.00
5924A	795.00
5933	15.25
6076	540.00
6076A	625.00
6146A	7.25
6146B	7.50
6155	70.00
6156	70.00
6161	395.00
6166A(7007)	2220.00
6696A	2790.00
6697A	2900.00
ML7007A	3390.00
7237A	525.00
7527	110.00
7527A	160.00
8008	16.00
8122	82.00
8791VI	405.00
8792VI	725.00
8873	185.00
8874	185.00
8875	185.00
8890	2400.0
8891	3300.00
8916	3100.00
8985	1600.00
8986	1225.00

CAMERA TUBES

Tube	Price
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BC4391 series	2140
BC4392 series	2270
BC4393R	2460
BC4394	2460
BC4532U	1325
BC4592 series	2195
BC4593R	2350
BC4594 series	2350
BC4809	720
BC4809B	720
BC4908 series	1875
BC4909	1955
BC4992 series	2280
BC4993R	2460
BC4994 series	2460
5820A L	3060
7295C	2835
7389C	2855
BC7735	240
BC8134	810
BC8134B	775
8480	1315
BC8480	1945
BC8507	270
BC8541	270

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Tube	Price
20PE11	26.25
20PE13A	26.25
20PE14	28.35
20PE19/S4097	28.35
20PE20/S4097A	28.35
4532U	285.00
7262A	30.35
7735A	30.85
7735B	165.00
8134	294.00
8507	150.00
8507A	245.00
8541	40.00
8541B	50.00
8758A	45.00
8823	30.00
8844	26.25
8929	30.00
S4075	279.50
S4076	318.50
S4092	299.00
S4102	305.00
S4113	344.00
S4119	403.00
S4140	403.00

AIR SYSTEM SOCKETS

Socket	Price
SK-300	470.00
SK-300A	325.00
SK-310	380.00
SK-400	235.00
SK-410	32.00
SK-500	336.00
SK-510	32.50
SK-600	47.00
SK-600A	46.25
SK-602	68.00
SK-602A	72.00
SK-607	56.00
SK-610	52.00
SK-610A	60.00
SK-611	41.00
SK-612	72.00
SK-620A	59.00
SK-630A	61.00
SK-640	34.00
SK-650	35.00
SK-1300	319.00
SK-1310	336.00
SK-1320	366.00
SK-1400A	430.00
SK-1420	570.00
SK-1470A	555.00
SK-1490	522.00
SK-1500A	984.00
SK-1510A	1149.00
SK-1920	19.00
SK-2200	76.00
SK-2210	64.00
SK-2220	292.00
SK-655	36.00
SK-660	37.00
SK-660A	35.00
SK-700	216.00
SK-710	207.00
SK-711A	207.00
SK-712A	207.00
SK-740	72.00
SK-760	72.00
SK-761	72.00
SK-770	80.00
SK-800B	240.00
SK-810B	260.00
SK-820	565.00
SK-830A	540.00
SK-831	286.00
SK-840	340.00
SL-860	207.00

AIR SYSTEM SOCKETS

Socket	Price
SK-890B	234.00
SK-900	283.00

CHIMNEYS

Chimney	Price
SK-3096	25.00
SK-316	25.00
SK-406	57.00
SK-416	27.00
SK-506	85.00
SK-516	105.00
SK-606	10.00
SK-626	10.00
SK-636B	29.00
SK-646	58.00
SK-656	58.00
SK-806	31.00
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SK-903	44.00
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SK-1406	32.00
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ASSR-1015	8008, 8008XE	35.00

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United Recording Electronics Industries
VIZ Mfg. Co.

Generators, Audio Sweep

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Leasametric, Inc.
Marconi Instruments Div. of Marconi Electronics Inc.
Rohde & Schwarz Sales Co.
Tektronix Inc.
United Recording Electronics Industries

Generators, Background Color

American Data Corp., A Div. of Central Dynamics Corp. See also Central Dynamics & Philips Broadcast Group
Automation Techniques, Inc.
Beaveronics, Inc.
Robert Bosch GmbH
Central Dynamics Corp. See also American Data Corp. & Philips Broadcast Group
Crosspoint Latch Corp.
Dubner Computer Systems, Inc.
Fernseh Inc.
For-A Corp. of America
Graham-Patten Systems, Inc.
Grass Valley Group, Inc.
Industrial Sciences, Inc. (ISI)
Lang Video Systems Corp.
Lenco Inc. Electronics Div.
Marconi Electronics Inc. Broadcast & Communication Div.
Philips Test & Measuring Instruments, Inc.
Shintron Co. Inc.
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Video Data Systems

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AVL Digital Ltd.
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Datatek Corp.
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Industrial Sciences, Inc. (ISI)
International Nuclear Corp.
JATEX, Inc.
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ECHOlab, Inc.
Edutron, Inc.
Fernseh Inc.
For-A Corp. of America
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Video Aids of Colorado
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Grove Video Corp.
Industrial Sciences, Inc. (ISI)
Interand Corp. Telestrator Div.
Lang Video Systems Corp.
MCI/Quantel
MPB Technologies Inc.
NEC America, Inc. Broadcast Equip. Div.
Spectra Computer Systems
Texscan/MSI Corp.
Vital Industries Inc.

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Circuit Research Labs, Inc.
Harris Corp. Broadcast Div.
Leader Instruments Corp.
Marti Electronics
McMartin Industries, Inc.
Micro Control Associates, Inc.
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Great announcer mics should be heard and not seen.

You won't see the MCE 5, but you will hear the rich full frequency sound that tells you it's a Beyer. Now the top quality and reliability for which Beyer is famous has been packaged into the world's smallest broadcast microphone – the MCE 5 – the announcer's mic.

The MCE 5 is an omni-directional electret condenser microphone with 20Hz-20kHz ± 3dB frequency response, 62dB signal-to-noise ratio and a maximum rated SPL at 1kHz of 116dB. Its matte black finish will not reflect light, so it goes unnoticed on camera. And Beyer's unique floating element eliminates pick-up of clothes rustle and body movement. Wind and air noises are reduced by up to 20dB, with the (removable) windscreen. You get only the announcer's voice.

Unlike conventional mini mics that are subject to breakdown from temperature and humidity, the MCE 5 is specially designed to withstand the elements.

The Beyer MCE 5 is available in a variety of configurations and connectors including: balanced, unbalanced, XLR, ¼-inch and open end; as well as phantom and self-powered with its own battery.

You may not find the Beyer MCE 5 on our announcer, but you'll find it at your local Beyer dealer, today.

ACTUAL SIZE.
Beyer Dynamic

Beyer Dynamic

BEYER DYNAMIC, INC.
5-05 Burns Avenue, Hicksville, NY 11801
(516) 935-8000 • In Canada, H. Roy Gray, Ltd.

Circle (128) on Reply Card

Can you find it?

Generators, Signal Dot Bar

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Grass Valley Group, Inc.
Hickok Elec. Inst. Co.
Leader Instruments Corp.
Lectrotech Inc.
Leitch Video Ltd.
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Robert Bosch GmbH
Exact Electronics/Dynatech Nevada Inc.
Global Specialties Corp.
HF Signalling Inc.
Hickok Elec. Inst. Co.
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C.N. Rood B.V.
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Sound Technology
Wilkinson Electronics, Inc.

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Robert Bosch GmbH
Broadcast Electronics, Inc.
Broadcast Microwave Services, Inc.
CSI Electronics, Inc.
Coastcom
Crosspoint Latch Corp.
Fernseh Inc.
Grass Valley Group, Inc.
Industrial Sciences, Inc. (ISI)
Leader Instruments Corp.
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Marti Electronics
McMartin Industries, Inc.
Micro Control Associates, Inc.
Modulation Associates Inc.
Moseley Associates, Inc.
Philips Test & Measuring Instruments, Inc.
C.N. Rood B.V.
Shintron Co. Inc.
Sigma Electronics, Inc.
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Robert Bosch GmbH
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CMX/Orrox Div. of Orrox Corp.
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Comex Systems
Di-Tech Inc.
Exact Electronics/Dynatech Nevada Inc.
Gorman-Redlich Mfg. Co.
Ivie Electronics, Inc.
Motorola Communications and Electronics Inc.
Opamp Labs, Inc.
QSI Systems Inc.
Shure Brothers Inc.
Spectra Sonics
VIF International

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Rohde & Schwarz Sales Co.
Video Aids of Colorado

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Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
Tektronix Inc.

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Datatek Corp.
Leader Instruments Corp.
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Marconi Instruments Div. of Marconi Electronics Inc.
Philips Test & Measuring Instruments, Inc.
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Hand Trucks, ENG Equipment

All Mobile Video
Coherent Communications
Comprehensive Video Supply Corp.
E-N-G Corp. Electronic News Group
Gruber Products Co.
Lee-Ray Industries, Inc.
Thermodyne International Ltd.

Head Alignment Gauges

Fidelipac Corp.
Merlin Engineering Works, Inc.
Multi-Track Magnetics, Inc.
Nagra Magnetic Recorders, Inc.
Nortronics Co., Inc. Recorder Care Div.
UMC Electronics Co. Broadcast Products Div.

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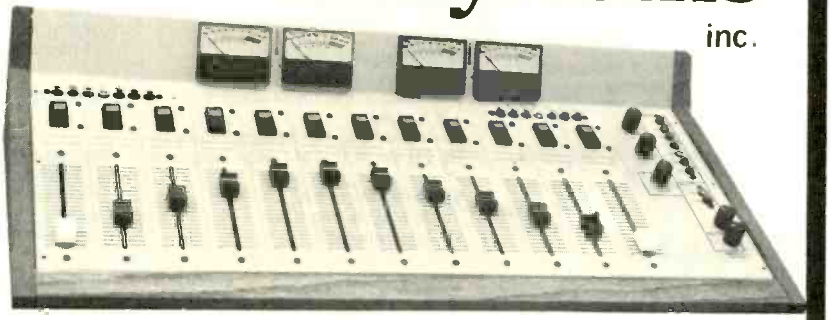
PROFESSIONAL CONSOLE SERIES By ARRAKIS systems inc.

2000SC



FEATURES

- 12 Channels
- 24 Balanced Inputs
- VCA Level Controls
- Reed Relay Switching
- Program, Audition Output
- Active or Transformer Circuitry.
- Remote Start Standard
- External Regulated Power Supply

DESCRIPTION

The 2000SC is designed for uncompromising performance & long life. VCA's (Voltage Controlled Amplifiers) mean that there is no audio on the slide fader & assure excellent stereo tracking. The program-audition switches are silent, momentary, & lighted. Remote start is standard. Gold plated miniature connectors make console wiring a joy. Cue is stereo.

The 2000SC will withstand 200 VDC & 5000 V transients on the active inputs. The console is available with any or all channels either active balanced or Jenson transformer balanced. The 2000SC is the ultimate in reliable performance.

$5650

ROUTING SWITCHER BREAKTHROUGH

100-RS AUDIO
ROUTING SWITCHER

FEATURES

- *16 in by 12 outputs mono
- *8 in by 12 outputs stereo
- *Expandable
- *Rack or table mounted
- *Balanced crosspoints
- *NE5532 Signetics IC's
- *1,000,000 operation thumbwheel select

INTRODUCTION

The 100RS represents a major price breakthrough in audio routing switchers. For the first time, electronic switchers are competitive with patch panels and other mechanical switches. Despite this dramatic improvement, the 100RS maintains professional specifications and construction throughout.

The 100RS audio routing switcher obviously has many possible applications in a broadcast or production studio. It replaces unwieldy patch panels, distribution amplifiers, and remote select mechanical switches. It can increase the total number of inputs at the control console and conveniently interconnect studios. It is ideal for switching satellite links to recorders, studios, or on the air. The possibilities are limited only by the imagination.

$1250

(303) 221-2918

ARRAKIS SYSTEMS 1713 WILLOX CT. FORT COLLINS, CO 80524

Circle (129) on Reply Card

Head Cleaning Products, Video

Allsop, Inc.
Comprehensive Video Supply Corp.
Fuji Photo Film USA, Inc. Magnetic Tape Div.
Nortronics Co., Inc. Recorder Care Div.
Robins Industries Corp.
Sony Corp. of America
3M Co. Magnetic A/V Products Div.
United Recording Electronics Industries

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Minneapolis Magnetics, Inc.
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Taber Mfg. & Eng. Co.
Videomagnetics, Inc.

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Bell & Howell Audio Visual Div.
Beyer Dynamic, Inc.
Clear-Com Intercom Systems
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Controlonics Corp.
East Coast Sound Inc.
Electro-Voice Inc.
Elektroimpex
Ercona Corp.
Fostex Electro Acoustics
G C Electronics Div. Wallace Murray
Glentronix (1977) Ltd.
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Micro-Trak Corp.
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Nortronics Co., Inc. Recorder Care Div.
Re: DB Co. A Div. of Pierce Industries Inc.
Saki Magnetics, Inc.
Taber Mfg. & Eng. Co.
VIF International

Heads, Contactor

Nortronics Co., Inc. Recorder Care Div.

Heads, Erase Magnetic

Brush Magnetic Heads Div.
Elektroimpex
Ercona Corp.
International Electro-Magnetics
JRF Co. Inc.
Magna-Tech Electronic Co., Inc.
Marathon Products Corp.
Minneapolis Magnetics, Inc.
Multi-Track Magnetics, Inc.
Nortronics Co., Inc. Recorder Care Div.
Re: DB Co. A Div. of Pierce Industries Inc.
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Taber Mfg. & Eng. Co.

Heads, Film Stripe

International Electro-Magnetics
JRF Co. Inc.
Magna-Tech Electronic Co., Inc.
Multi-Track Magnetics, Inc.
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Saki Magnetics, Inc.
Westrex Div. Litton Industries

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Nagra Magnetic Recorders, Inc.
Nortronics Co., Inc. Recorder Care Div.
Re: DB Co. A Div. of Pierce Industries Inc.
Ramko Research Inc.
Saki Magnetics, Inc.
Spin Physics, Inc.
UMC Electronics Co. Broadcast Products Div.
VIF International
Videomagnetics, Inc.

Heads, Video Recorder

Ampex Corp.
CMC Technology Corp.
Glentronix (1977) Ltd.
Javelin Electronics A Subs. of Kidde, Inc.
Minneapolis Magnetics, Inc.
RCA Broadcast Systems
Spin Physics, Inc.
Taber Mfg. & Eng. Co.
Videomagnetics, Inc.

Heat Exchangers

Comark Communications, Inc.
E. I. du Pont de Nemours & Co., Inc. Product Information
Electro Impulse, Inc.
Shively Laboratories Div. of Howell Labs, Inc.
Townsend Associates, Inc.

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Bell Helicopter Textron
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Microtime, Inc.
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CFA-Media Specialties, Inc.
Cetec Vega
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DYMA Engineering, Inc.
Dynamic Technology Ltd.
Dynatech Data Systems
Image Video Ltd.
McCurdy Radio Ind. Inc.
Potomac Instruments, Inc.
Rex Rheostat & Co., Inc.
E. Smalling III Consulting Engineer
Switchcraft Inc.
Symetrix Inc.
Tangent Systems, Inc.
Trompeter Electronics, Inc.
Union Connector Co., Inc.
Ward-Beck Systems, Inc.

Jacks, Meter Line

AVA Electronics
CSP Inc.
Delta Electronics Inc. (VA)
Multronics, Inc.

Keyers, Video Insert

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American Data Corp., A Div. of Central Dynamics Corp. See also Central Dynamics & Philips Broadcast Group
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Broadcast Video Systems, Ltd.
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Control Video Corp.
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Graham-Patten Systems, Inc.
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Image Video Ltd. 90
Industrial Sciences, Inc. (ISI)
Panasonic Company
3M Co. Magnetic A/V Products Div.
Torpey Controls & Eng. Ltd.
Video Associates Labs

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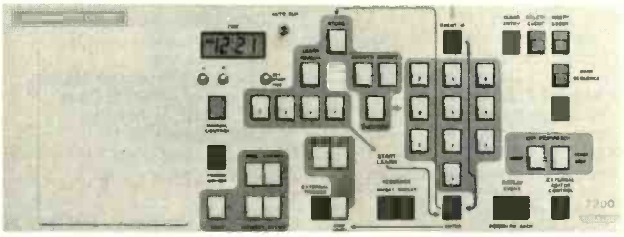
YOUR EDITOR CAN CONTROL OUR PRODUCTION SWITCHERS

AND GIVE YOU THE BEST OF BOTH WORLDS

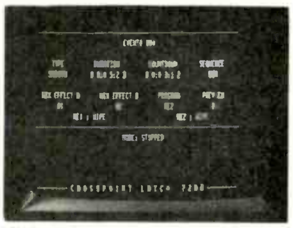
POST-PRODUCTION

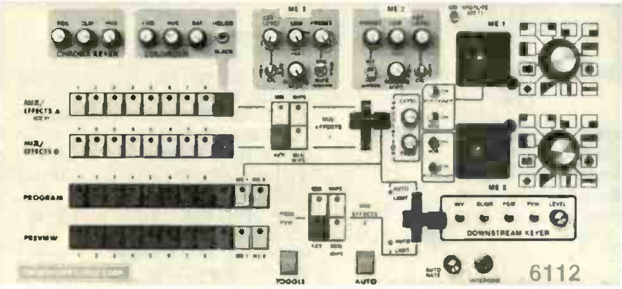
Highly sophisticated effects beyond the capability of your editor, yet timed to occur at the correct instant, triggered by the editor. The switcher can also be controlled directly from the editor keyboard, all transitions being entered on the edit list. But for those special occasions where the start and finish points of an effect or key is critical, full use can be made of our controllers, which allow accurate positioning using the color monitor as an interactive display. We even provide a choice of control; some parameters may be set up on the editor keyboard (such as duration times, input selection, etc.) while others (such as programmable start and finish points for partial wipes and keys) may be accurately set up on our controllers. The degree of sophistication is yours to choose. For most edits you have the convenience and the ability to operate from the editor keyboard alone.



We have a wide range of products, both for video and audio, to suit your requirements and needs. You may add programmable effects to the simplest editor, or elect to install a highly complex system with full computer control and many levels of storage. The 7200 AUTO DRIVE™ Controller is capable of storing the entire control panel status of the switchers, and producing smooth or abrupt transitions from one status to the next in a large number of programmable sequences. Transitions created by the 7200, (which are impossible to reproduce manually), can be triggered or controlled by editors.

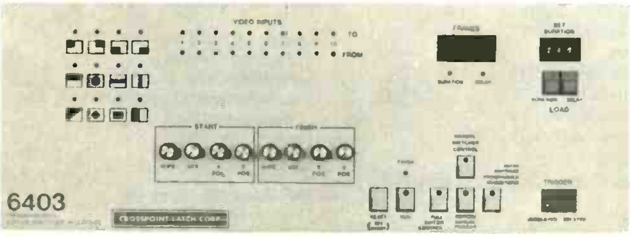
6124	**$ 13,700**
7200	**$ 12,500**
Editor Interface	**$ 3,000**
6403	**$ 2,700**
Editor Module	**$ 995**
6112	**$ 7,950**
6800	**$ 3,500**





PRODUCTION

Full production switchers, human engineered for ease of operation and versatility. The switchers have multiple effects with re-entries, keys, RGB or encoded chroma keyers. All switchers have dual back porch clamps and rock stable circuitry. The automatic blanking processor strips sync and burst from the incoming video signals, replacing it with constant amplitude signals. The blanking processor completely eliminates the flash or bounce when wiping or mixing between two signals that are not accurately timed or have tolerance variations between their sync and burst signals.



Consider the 6112 Production Switcher, with the 6403 Editor-Switcher Interface. This combination provides programmable effects capability to even the simplest of editors. Yet, add an editor module to the 6403 and you can then control the system directly from an editor keyboard. Audio follow, or break-away audio can be added initially, or later as the need arises, with the 6803 and the 6800.

EXPANDING YOUR SYSTEM

You can start with a switcher which meets your present requirements. Editor interfaces and audio may be added later as the need arises. Our products are fully plug compatible between one another and with editors. No modifications are necessary either to our products or editors in the expansion process.

We interface with most editors. Call us or your local dealer for details. Write or call for our very informative booklet **"Video-Post Production".** It will be sent to you **free.**

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(201) 688-1510 Telex 181160

CROSSPOINT LATCH CORP.

Circle (131) on Reply Card

Knobs, Control

Alco Electronic Products, Inc.
G C Electronics Div. Wallace Murray
Mallory Distributor Prod. Co. Mallory Components Group
Millen Components Elec. Instrument & Specialty Corp.
Multronics, Inc.
Selco Products Co.

Labels, Cartridge Tape

Comprehensive Video Supply Corp.
Fidelipac Corp.
Integrated Technology, Inc.
Marathon Products Corp.
See Hear Industries Div. of RJA Inc.
WIDL Video

Lamps, Console, Gooseneck

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Osram Sales Corp.
Shure Brothers Inc.

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B-W Lighting Systems (formerly Panoak Lighting)
Bardwell & McAlister, Inc.
Belden Communications, Inc.
CFA-Media Specialties, Inc.
Colortran, Inc.
East Coast Sound Inc.
Electronics Diversified, Inc.
General Electric Co. Video Display Equip. Op.
Kliegl Bros. Lighting
L. E. Nelson Corp.
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Osram Sales Corp.
Smith-Victor Corp.
Strand Century, Inc.
Sylvania Light/GTE

Leased Broadcast Equipment

All Mobile Video
Angenieux Corp. of America
Atlas Tower Corp.
CSI Electronics, Inc.
Cetec Broadcast Group
DYMA Engineering, Inc.
International Tapetronics Corp./3M
Leasametric, Inc.
McMartin Industries, Inc.
Merlin Engineering Works, Inc.
Old Dominion Broadcast Eng. Service
Phase Audio, Inc.
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Soll, Inc.
Tele-Cine Corp.
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UMC Electronics Co. Broadcast Products Div.
U.S. Instrument Rentals, Inc.
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Lens Repair Services

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Birns & Sawyer Inc.
Bush & Millimaki Services Inc.
Century Precision Cine/Optics
Ercona Corp.
Fujinon Optical, Inc.
Alan Gordon Enterprises Inc.
TSM-Total Spectrum Mfg. Inc.
Tele-Cine Corp.
The Zei-Mark Corp.

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JVC Co. of America
Jos. Schneider Optische Werke Aktiengesellschaft
Smith-Victor Corp.
Warren R. Smith Co. 224
TSM-Total Spectrum Mfg. Inc.
Tele-Cine Corp.
3D Video Corp.
VMI-Visual Methods Inc.
The Zei-Mark Corp.

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Buhl Optical Co.
Canon USA, Inc. Optics Div. 109
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Cinema Products Corp.
Comprehensive Video Supply Corp.
D.O. Industries, Inc.
Ercona Corp.
Frezzolini Electronics, Inc.
Fujinon Optical, Inc. 233
GBC Closed Circuit TV Corp.
Alan Gordon Enterprises Inc.
Karl Heitz, Inc.
Ikegami Electronics (U.S.A.), Inc.
Javelin Electronics A Subs. of Kidde, Inc.
Lenzar Optics Corp.
Panasonic Company
Schneider Corp. of America
Jos. Schneider Optische Werke Aktiengesellschaft
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Tele-Cine Corp.
3D Video Corp.
VMI-Visual Methods Inc.
The Zei-Mark Corp.

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Arriflex Corp.
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Canon USA, Inc. Optics Div. 109
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Cinema Products Corp.
Comprehensive Video Supply Corp.
D.O. Industries, Inc.
Ercona Corp.
Frezzolini Electronics, Inc.
Fujinon Optical, Inc. 233
GBC Closed Circuit TV Corp.
Alan Gordon Enterprises Inc.
Karl Heitz, Inc.
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Tamron Co., Ltd.
Tele-Cine Corp.
VMI-Visual Methods Inc.

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Bogen Photo Corp.
Walter S. Brewer Co., Inc.
CFA-Media Specialties, Inc.
CineMills Corp.
Colortran, Inc. 231
Design Line Inc.
Electro Controls
Gagnon LaForest Inc.
Janson Industries
Kliegl Bros. Lighting
LTM Corp. of America
Lowel-Light Mfg., Inc.
Matthews Studio Equipment, Inc.
Olesen
Packaged Lighting Systems
Smith-Victor Corp.
Strand Century, Inc.
Theatrical Services Inc.

Lighting, TV Portable System

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Colortran, Inc. 231
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Cool Light Co., Inc.
Dilor Industries Ltd.
Dynamic Technology Ltd.
Electro Controls
Electronics Diversified, Inc.
Frezzolini Electronics, Inc.
The Great American Market
Janson Industries
Kliegl Bros. Lighting
Kobold of America Corp.
LTM Corp. of America
Lowel-Light Mfg., Inc.
Lumitrol, Ltd.
L. E. Nelson Corp.
Olesen
Skirpan Lighting Systems, Inc.
Smith-Victor Corp.
Strand Century, Inc.
Theatre Techniques Inc.
Union Connector Co., Inc.
The Will-Burt Co. TMD Div.

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AVAB America Inc.
B-W Lighting Systems (formerly Panoak Lighting)
Bardwell & McAlister, Inc.
Belden Communications, Inc.
Walter S. Brewer Co., Inc.
CFA-Media Specialties, Inc.
CineMills Corp.
Colortran, Inc. 231
Comprehensive Video Supply Corp.
Cool Light Co., Inc.
Dilor Industries Ltd.
Dynamic Technology Ltd.
Electro Controls
Electronics Diversified, Inc.
The Great American Market
Jamieson & Associates, Inc.
Janson Industries
Kliegl Bros. Lighting
Kobold of America Corp.
LTM Corp. of America
Lowel-Light Mfg., Inc.
Lumitrol, Ltd.
Matthews Studio Equipment, Inc.
L. E. Nelson Corp.
Olesen
Packaged Lighting Systems
Skirpan Lighting Systems, Inc.
Smith-Victor Corp.
Strand Century, Inc.
Telaudio Centre
Teltone Corp.
Theatre Techniques Inc.
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Lighting Transformers

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LTM Corp. of America
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Cosmin Electronics 100
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EEV, Inc.
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MCG Electronics Inc.
Multiplier Industries Corp.
Topaz Inc./Electronics Div.
Transtector Systems Div. Konic International Corp.
Wilkinson Electronics, Inc.

Lights, HMI Ballast

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Cinema Products Corp.
CineMills Corp.
Colortran, Inc.
The Great American Market
Kobold of America Corp.
LTM Corp. of America
Mole-Richardson Co.
Osram Sales Corp.
Strand Century, Inc.

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Arriflex Corp.
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Bardwell & McAlister, Inc.
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Cinema Products Corp.
CineMills Corp.
Colortran, Inc.
Comprehensive Video Supply Corp.
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Film/Video Equip. Service Co.
Frezzolini Electronics, Inc.
Karl Heitz, Inc.
Kliegl Bros. Lighting
Kobold of America Corp.
LTM Corp. of America
Mole-Richardson Co.
Multiplier Industries Corp.
Osram Sales Corp.
Packaged Lighting Systems
Smith-Victor Corp.
Strand Century, Inc.

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All Mobile Video
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Bogen Photo Corp.
Walter S. Brewer Co., Inc.
Central Dynamics Corp. See also American Data Corp. & Philips Broadcast Group
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A VERY MOVING STILL STORY.

Introducing The Image Maker.™ For Editors, Engineers, Animators, Producers, Special Effects Specialists, Station Managers, Training and News Directors.

In the beginning, all was stillness. A dark and cumbersome, costly and inefficient sort of stillness accentuated by the *kachunka-kachunka* of the slide chain machinery. Then came Echo's Electronic Frame-Stor.™ And suddenly, all was stillness – and light.

But what excited the engineers at Echo wasn't stillness at all, but movement and, yes, re-movement. These were the challenging chapters to be written in the Still Story. How to make all of those electronically stored stills move around in all manner of ways. For this Still Story, a hero was needed.

Thus was born The Image Maker.

The Image Maker.
A Brief Definition.
Here's what The Image Maker is: A high-band color disc recording system that uses state-of-the-art electronics and an exclusive Discassette® recording medium to perform a versatile number of professional television production tasks from still frame storage to special animated effects.

Programmable Loops, Sequences, Special Effects.
The joy of The Image Maker – and the key to its success as a productivity tool – isn't just in its storage of still frames, but also in the manipulation of those stills to serve a variety of needs. In this regard, The Image Maker is a marvel of special effects wizardry, with variable speed operation all the way from freeze frame to real time, random access of as many as 512 frames on line and the ability to preset 64 locations. The convenient fingertip touch panel makes it just that much easier for the operator to do animation sequences, generate backgrounds, superimpose effects or preprogram motion loops.

From Cold Fronts To
Hot Switches: The Plot Thickens.
Because The Image Maker boasts variable speed in both directions, weather motion – or motion analysis of any kind is, well, a breeze. And because it also features two independent heads, the operator can preview upcoming video images, then "hot switch" to the next one without going to black.

Between the cold fronts and the hot switches are a full range of other capabilities. Instant replays. Logo and ID flashes. These are capabilities enhanced by the fact that The Image Maker will conveniently interface with today's modern character generators and titlers.

The Discassette.
The Removing Part Of The Story.
Not all of The Image Maker's innovations are located exclusively within the confines of the machine itself. In fact, one of the key innovations – and one unique to Echo products – is our patented Discassette, the removable recording medium that provides both operational and storage convenience. In this day and age, when space is at such a premium and ease of storage and retrievability are very real assets, a library of Discassettes sure beats drawers full of slides or closets stacked with disc packs.

Going Mobile With
The Image Maker.
Because we deal with some mighty tough customers, we build The Image Maker to be a mighty tough television production tool on the move. The combination of the recording technology (one that eliminates the possibility of head crash), Echo craftsmanship, and a compact, road-rugged design makes The Image Maker as versatile on remote shoots as it is in the studio.

A Moving Conclusion. Buy One.
Perhaps the most moving part of The Image Maker story is the one you read on the bottom line. Because, ultimately, it's the cost efficiency of The Image Maker that will move you to take a closer look. Clearly, it doesn't make a lot of sense to tie up a 1-inch VTR to do routine or special effects work when the feature-rich but modestly priced Image Maker can do that – and more. There's a happy ending to our Very Moving Still Story. Call us today and we'll write it together.

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LTM Corp. of America
Lowel-Light Mfg., Inc.
Mole-Richardson Co.
Multiplier Industries Corp.
L. E. Nelson Corp.
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United States Tower Co.
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Utility Tower Co.
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Line Surge Protectors

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Dielectric Communications A Unit of General Signal
DYMA Engineering, Inc.
EEV, Inc.
Lightning Elimination Assoc., Inc.
MCG Electronics Inc.
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Perma Power Electronics, Inc.
SGL Waber Electric
The Superior Electric Co.
Topaz Inc./Electronics Div.
Transtector Systems Div. Konic International Corp.
Vanner, Inc.
Wilkinson Electronics, Inc.

Loan Resistors

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Kappa Networks, Inc.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Maury Microwave Corp.
Micro Communications, Inc.
North Hills Electronics, Inc.
Rex Rheostat & Co., Inc.
Shively Laboratories Div. of Howell Labs, Inc.
Wilkinson Electronics, Inc.

Low Frequency Extenders

Comrex Corp.

Maintenance Services, AM

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Old Dominion Broadcast Eng. Service
Radiotechniques
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Utility Tower Co.
World Tower Co. Inc.

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Fort Worth Tower Co.
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Harris Corp. Broadcast Div.
Harrison Systems Ltd.
Fred A. Nudd Corp. 258
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Radiotechniques
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World Tower Co. Inc.

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Andrew Corp.
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Comark Industries Inc.
Design Line Inc.
Fort Worth Tower Co.
Gabriel Electronics, Inc.
Harris Corp. Broadcast Div.
Harris Corp. Broadcast Microwave
Lang Video Systems Corp.
Microwave Assoc. Communications
Fred A. Nudd Corp. 258
Radiotechniques
Utility Tower Co.
World Tower Co. Inc.

Maintenance Services, TV

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Alpha Video & Electronics Co.
Robert Bosch GmbH
Broadcast Aids, Inc.
Centro Corp.
Cinema Products Corp.
Comark Industries Inc.
Electrohome Ltd.
Fort Worth Tower Co.
G. A. Gilbreath Associates Inc.
Harris Corp. Broadcast Div.
Harrison Systems Ltd.
Lang Video Systems Corp.
Merlin Engineering Works, Inc.
Fred A. Nudd Corp. 258
The Real World Tech. Group, Inc.
E. Smalling III Consulting Engineer
Soll, Inc.
Tele-Measurements Inc.
Townsend Associates, Inc.
Utility Tower Co.
Varian Associates Electron Device Group
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Meters, Blanking Interval

Auburn Instruments
Grumman Aerospace Corp.
World Video Inc.

Meters, Burst Phase

Bruel & Kjaer Instruments, Inc.
Video Aids of Colorado

Meters, Field Strength RF

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Audio Technology
Avantek Inc.
Belar Electronics Lab., Inc.
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CSP Inc.
Delta Electronics Inc (VA)
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Asaca/Shibasoku Corp.
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Fidelipac Corp.
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Leader Instruments Corp.
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Meters, Frequency AF

Amber Electro Design, Ltd.
Global Specialties Corp.
HF Signalling Inc.
Hickok Elec. Inst. Co.
Ivie Electronics, Inc.
Leader Instruments Corp.
Leasametric, Inc.
Rycom Instruments

Meters, Frequency RF

Belar Electronics Lab., Inc.
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Global Specialties Corp.
Harris Corp. PRD Electronics Div.
Hickok Elec. Inst. Co.
Leader Instruments Corp.
Leasametric, Inc.

Meters, Frequency Calibrating

Eidson Electronic Co.
Global Specialties Corp.

Meters, Line Voltage

Gralex Industries
Leasametric, Inc.
Motorola Communications and Electronics Inc.
VIZ Mfg. Co.

Meters, Modulation

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ADM Technology, Inc.
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Harrison Systems, Inc.
Inovonics Inc.
Logitek Electronic Systems, Inc.
Modulation Sciences, Inc.
The Real World Tech. Group, Inc.
C.N. Rood B.V.
Selco Products Co.
Westrex Div. Litton Industries

Meters, Phase Angle

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Audio Technology
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Harris Corp. PRD Electronics Div.
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Rohde & Schwarz Sales Co.

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The "Studio Optimod"

orban
GATED COMPRESSOR/LIMITER
DE-ESSER
MODEL 424A
A
B

The Orban 424A Gated Compressor/ Limiter/De-Esser

There are lots of production limiters out there. Old favorites. Pretenders to the throne. The competition is fierce. So, when Orban set out to design a new production limiter, we knew it had better be superior.

The result of our research is the "Studio Optimod"—a Gated Compressor/Limiter/De-Esser with versatile controls, simple set-up, and a natural, transparent sound that must be heard to be appreciated.

Try one and A/B it against your current favorite. You'll notice the **sound**—remarkably smooth and natural over a wide range of control settings—even at high compression ratios where apparent loudness and punch are significantly enhanced. It's no accident: The unit is a direct descendent of our super-popular, second-generation OPTIMOD-FM broadcast limiter. So it exploits our years of experience in making an AGC device sound natural on diverse program material without critical re-adjustments. Yet full versatility exists for special effects in production.

A bonus is a smooth, natural de-esser. It's independent of the compressor/limiter section so you can simultaneously compress and de-ess vocal material without compromise. You can even de-ess sibilant vocals which have been mixed with other program.

The icing on the cake is unique gating and "idle gain" functions which prevent unnatural noise-producing gain variations during pauses and abrupt gain changes when the unit is switched in.

Our new Model 424A (dual channel) and 422A (single channel) are destined to become the new industry standards in dynamic range control. Prove it to yourself. Contact your Orban dealer today.

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Meters, RF

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Meters, Standing Wave

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G C Electronics Div. Wallace Murray
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NEW
WIRELESS

Model 82
Wireless Condenser
Hand-Held

The Model 82 condenser wireless microphone has been added to Cetec Vega's professional hand-held line. The Model 82 incorporates the popular Shure SM85 condenser element and attractive black windscreen to provide:

- Minimal handling noise, reduced mechanical vibration, and virtually no "boominess" (by means of controlled low-frequency rolloff).
- Clean reproduction of close-up vocals with moderate proximity effect.
- "Crispness" and presence with high-definition midrange.
- Clear, scintillating highs with crisp upper register.
- Cardioid pickup pattern for effective rejection of off-axis sounds.

All Cetec Vega hand-held wireless microphones (including the Model 80 with the Electro-Voice EV-671 dynamic element and the Model 81 with the Shure SM58 dynamic element) have an attractively contoured black case with internal antenna.

Used with Cetec Vega professional wireless receivers, the FM systems operate on any crystal-controlled frequency between 150 to 216 MHz, at a range up to 1000 feet or more. Transmit-to-receive frequency response is almost perfectly flat from 100 Hz to 12 kHz with gentle rolloffs to 40 Hz and 15 kHz. Total harmonic distortion is typically 1/2 percent. System dynamic range is 90 dB when "Dynex" (transmit compression and receive expansion) is incorporated, with a resulting low noise floor.

Cetec Vega hand-held wireless microphones are newly redesigned for 20 to 30 percent additional battery life, using a commonly available 9-volt alkaline battery (Duracell recommended). Microphone sensitivity is easily adjustable with an audio gain control on the bottom, with an adjacent LED indicator to verify optimum setup. Power and audio on/off switches are also conveniently located on the bottom.

Write or call for further information and location of your nearest dealer: Cetec Vega, P.O. Box 5348, El Monte, CA 91731. (213) 442-0782 TWX: 910-587-3539

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Alford Mfg. Co.
All Mobile Video
B & K Precision Dynascan Corp.
Electronic Visuals Ltd.
Leasametric, Inc.
Lectrotech Inc.
Philips Test & Measuring Instruments, Inc.
Tektronix Inc.
Ultra Audio Pixtec
Videotek, Inc.

Oscilloscopes, Dual Trace

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All Mobile Video
B & K Precision Dynascan Corp.
Glentronix (1977) Ltd.
Gould Inc. Instruments Div.
Hickok Elec. Inst. Co.
Hitachi Denshi America, Ltd.
Leader Instruments Corp. 5
Leasametric, Inc.
Lectrotech Inc.
Motorola Communications and Electronics Inc.
North American Soar Corp.
Philips Test & Measuring Instruments, Inc.
Tektronix Inc.
VIZ Mfg. Co.

Oscilloscopes, Triggered Sweep

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All Mobile Video
B & K Precision Dynascan Corp.
Gould Inc. Instruments Div.
Hickok Elec. Inst. Co.
Leader Instruments Corp. 5
Leasametric, Inc.
Lectrotech Inc.
Motorola Communications and Electronics Inc.
North American Soar Corp.
Philips Test & Measuring Instruments, Inc.
Tektronix Inc.

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VIZ Mfg. Co.

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ComSonics, Inc.
Gould Inc. Instruments Div.
Hickok Elec. Inst. Co.
Leader Instruments Corp. 5
Leasametric, Inc.
Lectrotech Inc.
North American Soar Corp.
Philips Test & Measuring Instruments, Inc.
Tektronix Inc.

Parts and Components, Electronic

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American Photonics Inc.
Broadcast Electronics, Inc.
CSP Inc.
EEV, Inc.
Ercona Corp.
G C Electronics Div. Wallace Murray
Global Specialties Corp.
ILC Data Devices Corp.
Lang Video Systems Corp.
Merlin Engineering Works, Inc.
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Altec Lansing Int'l.
Atlantic Research Corp.
Audio Accessories, Inc.
Auditronics, Inc.
AVA Electronics
B-W Lighting Systems (formerly Panoak Lighting)
Robert Bosch GmbH
Brabury Group
CFA-Media Specialties, Inc.
Colortran, Inc.
Comark Industries Inc.
Comprehensive Video Supply Corp.
Datatronix, Inc.
Dielectric Communications A Unit of General Signal
Dilor Industries Ltd.
DYMA Engineering, Inc.
Dynamic Technology Ltd.
Dynatech Data Systems
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Micro Communications, Inc.
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Phelps Dodge Communications Co.
Potomac Instruments, Inc.
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Strand Century, Inc.
Switchcraft Inc.
Tangent Systems, Inc.
TEAC Corp of America
Theatre Techniques Inc.
Trompeter Electronics, Inc.
Union Connector Co., Inc.
Vector Electronic Co., Inc.
Vidaire Electronics Mfg. Corp.

Phase Converters, Single to Three Phase

California Instruments Div. of Amstar Tech. Products Co., Inc.
Kay Industries, Inc.

Phase Enhancers, Stereo

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Phono Tracking Force Gauges

Shure Brothers Inc.

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Don Britton Enterprises
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Centro Corp.
DYMA Engineering, Inc.
HN Engineering Inc.
Jamieson & Associates, Inc.
Lakeside Associates Inc.
Radiotechniques
The Real World Tech. Group, Inc.
Ruslang Corp.
E. Smalling III Consulting Engineer
Soll, Inc.

Pointers, Video Screen

Central Dynamics Corp. See also American Data Corp. & Philips Broadcast Group
Ednalite Corp.
Industrial Sciences, Inc. (ISI)
Interand Corp. Telestrator Div.

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Altec Lansing Int'l.
Anton/Bauer, Inc.
Audisar
California Instruments Div. of Amstar Tech. Products Co., Inc.
Cine 60, Inc.
Comprehensive Video Supply Corp.
Delta Electronics Inc. (N.C.)
Dynamote Corp.
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Microwave Assoc. Communications
Modulation Associates Inc.
Motorola Communications and Electronics Inc.
Nagra Magnetic Recorders, Inc.
Opamp Labs, Inc.
Perrott Eng. Labs, Inc.
Quad-Eight Electronics
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Tweed Audio USA Inc.
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Vanner, Inc.
VIZ Mfg. Co.

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Acoustilog Inc.
Altec Lansing Int'l.
Amek Systems & Controls Ltd.
American Data Corp., A Div. of Central Dynamics Corp. See also Central Dynamics & Philips Broadcast Group
Arrakis Sytems Inc.
Atlantic Research Corp.
Audio & Design (Audio & Design Recording, Inc.)
Audio Technology
Audisar
Autogram Corp.
Bell Audio Systems, Inc.
Bogen Div. Lear Siegler, Inc.
Broadcast Electronics, Inc.
Broadcast Technology, Inc.
Bryston Mfg. Ltd.
Brystonvermont Ltd.
Cetec Broadcast Group
Continental Electronics Mfg. Co.
Crown International, Inc.
Datatronix, Inc.
Delta Electronics Inc. (N.C.)
DYMA Engineering, Inc.
Dynair Electronics, Inc.
Edcor
Excalibur Electronics, Inc.
Furman Sound, Inc.
G C Electronics Div. Wallace Murray
Hammond Industries Inc.
Integrated Sound Systems Inc.
International Nuclear Corp.
Ivie Electronics, Inc.
Logitek Electronic Systems, Inc.
McCurdy Radio Ind. Inc.
McMartin Industries, Inc.
Micro-Trak Corp.
Modular Audio Products Unit of Modular Devices, Inc.
Motorola Semiconductor Products Inc.
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Sescom, Inc.
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Shure Brothers Inc.
Sono-Mag Corp.
Sontec Electronics
Spectra Sonics
Sphere Electronics
Stanton Magnetics Inc.
Straight Wire Audio, Inc. 220
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Telex Communications, Inc.
United Recording Electronics Industries
VIF International
Valley People, Inc.
Westlake Audio Professional Products Mfg. Group
Wilkinson Electronics, Inc.
Yamaha International Corp. Combo Div.

Preamplifiers, Limiter-Compressor

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ATI-Audio Technologies Inc.
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Ashly Audio
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DYMA Engineering, Inc.
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Richmond Sound Design, Ltd.
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Spectra Sonics
Ultra Audio Pixtec
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Valley People, Inc.

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Amek Systems & Controls Ltd.
Arrakis Sytems Inc.
Audio & Design (Audio & Design Recording, Inc.)
Audio Service Corp.
Audisar
Autogram Corp.
Bogen Div. Lear Siegler, Inc.
Broadcast Electronics, Inc.
Broadcast Technology, Inc.
Bruel & Kjaer Instruments, Inc.
Crown International, Inc.
Datatronix, Inc.
DYMA Engineering, Inc.
Edcor
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Harrison Systems, Inc.
Howe Audio Productions, Inc.
ITI Electronics, Inc.
Ivie Electronics, Inc.
Micro-Trak Corp.
Modular Audio Products Unit of Modular Devices, Inc.
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Straight Wire Audio, Inc.
Valley People, Inc.

Preamplifiers, Microwave

Amplica, Inc.
Avantek Inc.
Broadcast Microwave Services, Inc.
Harris Corp. Satellite Communications Div.
M/A-Com Microwave Power Devices
Mu-Del Electronics, Inc.
North Hills Electronics, Inc.
RHG Electronics Laboratory, Inc.
Tayburn Electronics, Inc.

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Allied Broadcast Equipment
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Broadcast Audio Corp.
Broadcast Electronics, Inc.
Bryston Mfg. Ltd.
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Cetec Broadcast Group
Continental Electronics Mfg. Co.
Crown International, Inc.
D-B Electronics, Inc.
Datatronix, Inc.
DYMA Engineering, Inc.
EMT-FRANZ GMBH
Excalibur Electronics, Inc.
Hammond Industries Inc.
Howe Audio Productions, Inc.
LPB Inc.
Logitek Electronic Systems, Inc.
McCurdy Radio Ind. Inc.
McMartin Industries, Inc.
Micro-Trak Corp.
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International Nuclear Corp.
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Pressurization Equipment, Transmission Line

Andrew Corp.
Cablewave Systems Inc.
Dielectric Communications A Unit of General Signal
Shively Laboratories Div. of Howell Labs, Inc.

Probes, Oscilloscope

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Lectrotech Inc.
North American Soar Corp.
Philips Test & Measuring Instruments, Inc.
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Publison Audio Professional
Pyramid Loudspeaker Corp.
Richmond Sound Design, Ltd.
Sequential Circuits, Inc.
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Shure Brothers Inc.
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Studio Technologies, Inc.
Studiomaster Inc.
Tangent Systems, Inc.
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Canter-Redman Technologies
Composite Video
Electrocraft Consultants Ltd.
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Image Resource Corp.
Industrial Sciences, Inc. (ISI)
King Instrument Corp.
Knox Video Products
Kreonite, Inc.
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Marconi Electronics Inc. Broadcast & Communication Div.
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Processors, Bleach Regeneration

Eastman Kodak Co.

Processors, Electronic Still

ADDA Corp.
Grove Video Corp.
Harris Corp. Broadcast Div.
MCI/Quantel

Programmer/Comparators

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Broadcast Aids, Inc.
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Microprobe Electronics, Inc.
Tape-Athon Corp. Cavox Stereo Productions

Projector Lamps/Accessories

Belden Communications, Inc.
Bell & Howell Audio Visual Div.
Calzone Case Co.
Eastman Kodak Co.
Hammond Industries Inc.
Osram Sales Corp.
Packaged Lighting Systems
Schuessler Case Co., Inc.
Varian Associates Electron Device Group

Projectors, Film

B.E.I. (Beston Electronics Inc.)
Bell & Howell Audio Visual Div.
Calzone Case Co.
Dukane Corp. Audio Visual Div.
Eastman Kodak Co.
Elektroimpex
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Optical Radiation Corp.
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Westrex Div. Litton Industries
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Calzone Case Co.
Dukane Corp. Audio-Visual Div.
General Electric Co. Video Display Equip. Op.
Hudson Photographic Industries
Pioneer Marketing Corp.
Radmar, Inc.
Research Technology Int'l.

Projectors, Slide

Buhl Optical Co.
Calzone Case Co.
Eastman Kodak Co.
The Great American Market
Hammond Industries Inc.
Kliegl Bros. Lighting
Laird Telemedia Inc.
Optical Radiation Corp.
Osram Sales Corp.
Pioneer Marketing Corp.
Radmar, Inc.
Spindler & Sauppe, Inc.
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Sony Corp. of America
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B.E.I. (Beston Electronics Inc.)
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Telescript, Inc.

Proof Workbook (For FCC Test Requirements)

All Mobile Video
Intertec Publishing Corp.

Pulse Assignment Systems

Audico, Inc.
Robert Bosch GmbH
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Grass Valley Group, Inc.
Leitch Video Ltd.

Purchasing Services, Broadcast Equipment

A. F. Associates, Inc.
Robert Bosch GmbH
CSP Inc.
Centro Corp.
DYMA Engineering, Inc.
Old Dominion Broadcast Eng. Service

Radar, Weather

Advanced Designs Corp.
Colorgraphics Weather Systems, Inc.
Denrad Technical Group
Enterprise Electronics Corp.
Kavouras Inc.
Oktel Corp.
Satellite Broadcast Network, Inc. Weathermation, Inc.
Spectra Computer Systems
Sperry Marine Systems Sperry Corp.
Sperry Weather Systems
Technology Service Corp. Commercial Operations
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Radomes

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Cetec Antennas
Cetec Broadcast Group
Gabriel Electronics, Inc.
Micro Communications, Inc.
Nurad, Inc.
Shively Laboratories Div. of Howell Labs, Inc.
Tayburn Electronics, Inc.

Receivers, AM

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Bell Audio Systems, Inc.
Bogen Div. Lear Siegler, Inc.
Communitronics Ltd.
Delta Electronics Inc. (VA)
International Microwave Corp.
Kahn Communications, Inc.
McKay Dymek, Inc.
McMartin Industries, Inc.
Panasonic Company
Potomac Instruments, Inc.
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Broadcast Microwave Services, Inc.
Communitronics Ltd.
Datum Inc.
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Kahn Communications, Inc.
Marconi Electronics Inc. Broadcast & Communication Div.
McKay Dymek, Inc.
Nagra Magnetic Recorders, Inc.
Scientific Radio Systems, Inc.

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Gorman-Redlich Mfg. Co.
International Nuclear Corp.
Johnson Electronics Inc.
McMartin Industries, Inc.
Microwave Assoc. Communications
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Amplica, Inc.
Antenna Development & Mfg., Inc.
Automation Techniques, Inc.
Avantek Inc.
Blonder-Tongue Lab., Inc.
Broadcast Microwave Services, Inc.
California Microwave
Coastcom
Comtech Data Corp.
Dalsat, Inc.
Discom Satellite Systems, Inc.
Electrohome Ltd.
H & R Communications
Harris Corp. Satellite Communications Div.
LNR Communications, Inc.
Lang Video Systems Corp.
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United States Tower Co.
Western Tele-Communications, Inc.
Winegard CATV Div.

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Bang & Olufsen of America
Bell Audio Systems, Inc.
Bogen Div. Lear Siegler, Inc.
Broadcast Microwave Services, Inc.
Catel Div. United Scientific Corp.
Communitronics Ltd.
Emergency Alert Receiver Inc.
International Microwave Corp.
Johnson Electronics Inc.
LNR Communications, Inc.
Marti Electronics
McMartin Industries, Inc.
Panasonic Company
Pyramid Loudspeaker Corp.
RHG Electronics Laboratory, Inc.
Rohde & Schwarz Sales Co.
The Ken Schaffer Group, Inc.
Sharp Electronics Corp. Professional Products Div.
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Wilkinson Electronics, Inc.

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Datum Inc.
Harris Corp. Broadcast Microwave
Harris Corp. Satellite Communications Div.
International Microwave Corp.
Lang Video Systems Corp.
Marti Electronics
Microdyne Corp.
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Rockwell Int'l. Commercial Elec. Operations
Scientific-Atlanta, Inc.
Tayburn Electronics, Inc.
Tepco Corp.
Varian Associates Electron Device Group

Receivers, Multiplex

Bayly Engineering Ltd. Member of AEG-Telefunken Group
Coastcom
International Microwave Corp.
Johnson Electronics Inc.
McMartin Industries, Inc.
Modulation Associates Inc.
Moseley Associates, Inc.
Pyramid Loudspeaker Corp.

Receivers, SCA

Bogen Div. Lear Siegler, Inc.
Contel Mfg. Div. of Continental Elec. Wholesale Corp.
Emergency Alert Receiver Inc.
Johnson Electronics Inc.
Marti Electronics
McMartin Industries, Inc.

Receivers, Time Signal

Catel Div. United Scientific Corp.
Communitronics Ltd.
Datametrics Inc.
Datum Inc.
ESE
Scientific Radio Systems, Inc.
True Time Instruments

Receivers, TV

Robert Bosch GmbH
Elector
Electrohome Ltd.
Harris Corp. Satellite Communications Div.
Image Magnification, Inc.
JVC Co. of America
Panasonic Company
Panasonic Industrial Co. Video Systems Div.
Sharp Electronics Corp. Professional Products Div.
Sony Corp. of America
Techtran Int'l. Inc.

Receivers, Weather

Advanced Designs Corp.
Catel Div. United Scientific Corp.
Communitronics Ltd.
Emergency Alert Receiver Inc.
Gorman-Redlich Mfg. Co.
Kavouras Inc.
Motorola Communications and Electronics Inc.
Nagra Magnetic Recorders, Inc.
Scientific Radio Systems, Inc.
Spectra Computer Systems

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Discwasher
Panasonic Company
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Recorder Amplifiers

Audio Service Corp.
Calzone Case Co.
Datatronix, Inc.
Gould Inc. Instruments Div.
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International Tapetronics Corp./3M
Studer Revox America
Taber Mfg. & Eng. Co.
Telectro Systems Corp.
Telex Communications, Inc.
United Research Lab Corp.
VIF International
Westrex Div. Litton Industries

Recorder Care Products

Allsop, Inc.
Comprehensive Video Supply Corp.
Discwasher
Fidelipac Corp.
Marathon Products Corp.
Nortronics Co., Inc. Recorder Care Div.
Robins Industries Corp.
See Hear Industries Div. of RJA Inc.
VIF International

Recorder Carrying Systems, Videotape Portable

All Mobile Video
Robert Bosch GmbH
Calzone Case Co.
Comprehensive Video Supply Corp.
Gruber Products Co.
Javelin Electronics A Subs. of Kidde, Inc.
K & H Products
Lee-Ray Industries, Inc.
Panasonic Company
Thermodyne International Ltd.

Recorder Drive Motor Power Supply Units

Datatronix, Inc.
Merlin Engineering Works, Inc.

Recorder Modification/Attachments, Extended Play

Merlin Engineering Works, Inc.
Recortec, Inc.

Recorder Modifications, Reel Servo

Acoustilog Inc.
Alpha Video & Electronics Co.
Audio Service Corp.
Inovonics Inc.
Merlin Engineering Works, Inc.
Mineroff Electronics, Inc. Uher Products
Multi-Track Magnetics, Inc.
Recortec, Inc.
Telectro Systems Corp.

Recorder Reconditioning, Videotape

A. F. Associates, Inc.
Alpha Video & Electronics Co.
Merlin Engineering Works, Inc.
RCA Broadcast Systems
Taber Mfg. & Eng. Co.

Recorder Replacement Capstan Assembly

Audio Service Corp.
Century 21 Programming Inc.
United Research Lab Corp.

Recorder Replacement Electronics

Audio Service Corp.
Century 21 Programming Inc.
Inovonics Inc.
Merlin Engineering Works, Inc.
Mineroff Electronics, Inc. Uher Products
Opamp Labs, Inc.
Sontec Electronics
Studer Revox America
Taber Mfg. & Eng. Co.
United Research Lab Corp.
VIF International

Recorder Replacement Motors

Broadcast Electronics, Inc.
Century 21 Programming Inc.
Merlin Engineering Works, Inc.
UMC Electronics Co. Broadcast Products Div.
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Merlin Engineering Works, Inc.
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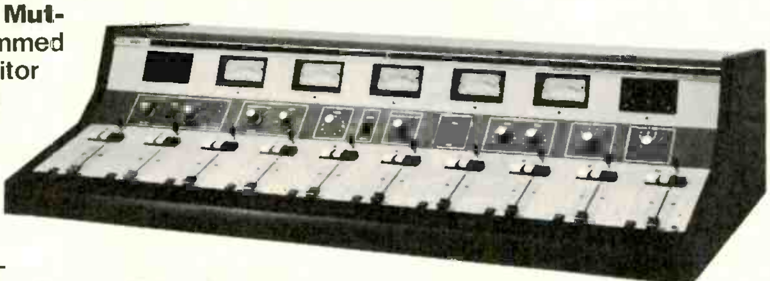
Everything you want in an audio console:

4 Models—8 and 10 mixer dual stereo with rotary or linear faders • **Transformer Balanced Inputs and Outputs** • **3 Inputs Per Mixer**—internal pads allows mic/line selection on the same mixer • **Two 4-Input Auxiliary Input Selectors**—may be assigned to any mixer • **Pre-fader Pushbutton Cue**—in addition to normal CCW fader cue position • **LED Status Indicators**—color coded to aid in instant identification of function selectors • **Momentary or Continuous Remote Control Contacts**—internally selectable, also controls optional digital timer reset/start • **Full Metering Capability**—two meters standard, up to four meters and/or digital clocks and timers optionally available, all meters provided with LED peak indicators • **Gain Selectable Microphone Preamps**—provided with center tap access for phantom condenser microphone power, processor input/output port with buffer amplifier for outboard compressors, limiters, etc. • **Programmable Muting Logic**—internal pin-programmed matrix allows any selection of monitor and cue muting for the first five mixer positions • **Pushbutton Aural Phase Test** • **Announcer's Microphone Intercom-Air Selector** • **Full Dual Channel Operation**—independent program and audition assignment pushbuttons • **Five Monitor Driver Outputs**—four muted, one non-muted • **All Mixers Switch Selectable to Mono or Stereo** • **Ground-Plane Techniques Used Throughout for Increased RF Immunity** • **Selectable Internal or External Master Level Controls** • **Accessories and Options**—mono mixdown, high impedance (cassette) line input plug-ins, reference oscillator/line input plug-in, additional microphone input plug-ins, digital clock, digital timer, linear faders.



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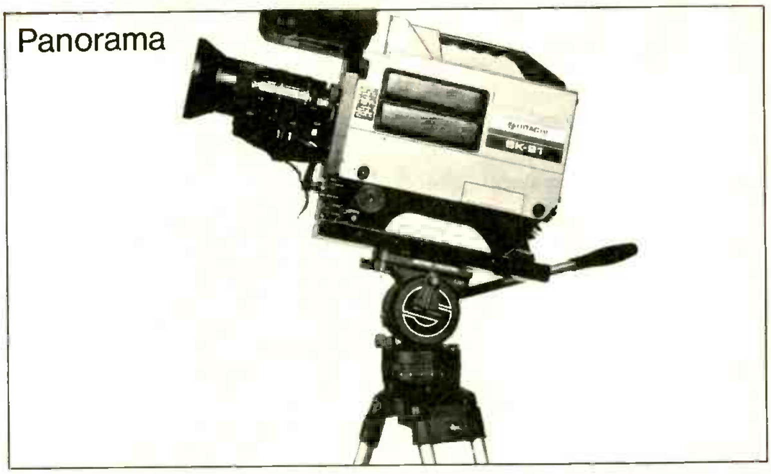
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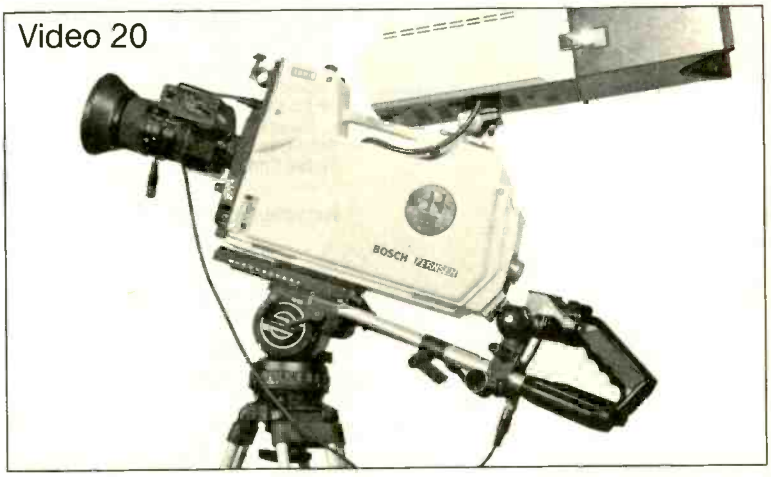
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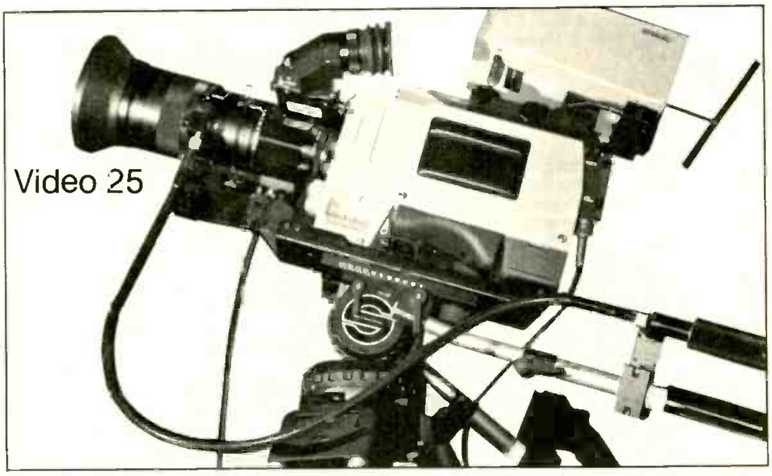
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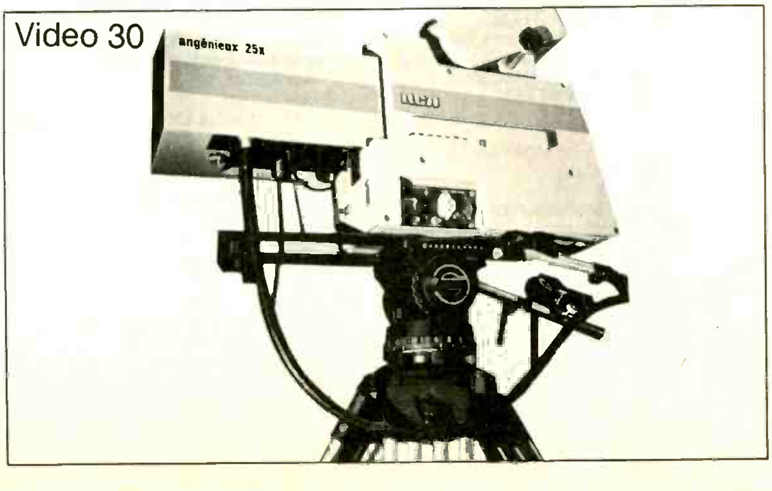
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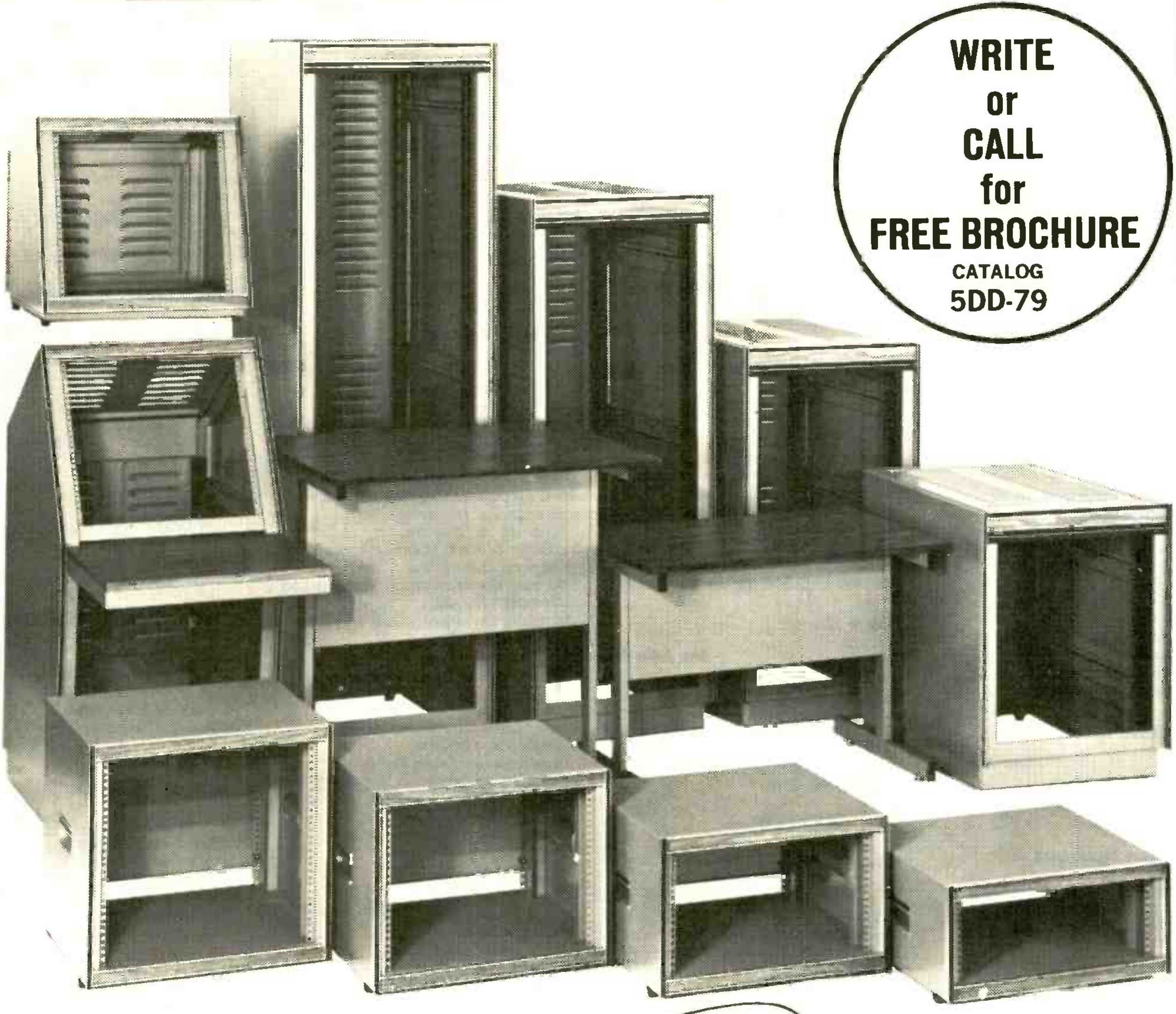

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Thomas Valentino Inc.

Voltmeters, AC

B & K Precision Dynascan Corp.
Boonton Electronics Corp.
Bruel & Kjaer Instruments, Inc.
John Fluke Mfg. Co., Inc.
Gralex Industries
HF Signalling Inc.
Hickok Elec. Inst. Co.
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Leader Instruments Corp.
Leasametric, Inc.
North American Soar Corp.
Rohde & Schwarz Sales Co.
Rycom Instruments
Tektronix Inc.
VIZ Mfg. Co.

Voltmeters, DC

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Bruel & Kjaer Instruments, Inc.
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Gralex Industries
Hickok Elec. Inst. Co.
Leader Instruments Corp.
Leasametric, Inc.
North American Soar Corp.
Rohde & Schwarz Sales Co.
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VIZ Mfg. Co.

Voltmeters, FET

B & K Precision Dynascan Corp.
John Fluke Mfg. Co., Inc.
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Leader Instruments Corp.
Leasametric, Inc.
VIZ Mfg. Co.

Voltmeters, VOM

B & K Precision Dynascan Corp.
John Fluke Mfg. Co., Inc.
G C Electronics Div. Wallace Murray
Hickok Elec. Inst. Co.
Leader Instruments Corp.
Leasametric, Inc.
Motorola Communications and Electronics Inc.
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Vidaire Electronics Mfg. Corp.
VIZ Mfg. Co.

Voltmeters, VTVM

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Spectra Computer Systems
Sperry Weather Systems
Technology Service Corp. Commercial Operations
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Weather Services Corp.

Weather Instruments

Information Processing Systems Of California, Inc.
Kavouras Inc.
Nagra Magnetic Recorders, Inc.
Satellite Broadcast Network, Inc. Weathermation, Inc.
Spectra Computer Systems
Taylor Consumer Industrial Instruments, Sybron Corp. Consumer Prod. Div. Sybron Corp.
Texas Electronics
Video Data Systems

Weather Radar --See Radar, Weather

Wiring and Cabling Services

Acoustilog Inc.
Audio Accessories, Inc.
AVA Electronics
BIW Cable Systems, Inc.
B-W Lighting Systems (formerly Panoak Lighting)
Belden Corp. Electronics Div.
CSP Inc.
Cablewave Systems Inc.
Canford Audio
Comprehensive Video Supply Corp.
DYMA Engineering, Inc.
Harrison Systems Ltd.
Lakeside Associates Inc.
Marshall Electronics
Old Dominion Broadcast Eng. Service
Reel-O-Matic Systems, Inc.
Rex Rheostat & Co., Inc.
SGL Waber Electric
E. Smalling III Consulting Engineer
Sono-Mag Corp.
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Wireworks Corp.

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With General Electric's exclusive sealed light valve and sealed Xenon lamp system, in both color and monochrome General Electric Professional Large Screen Video Projectors, you can depend on sharp pictures from 2 to 25 feet wide. New high brightness models allow the room lighting viewers need to take notes and refer to written material.

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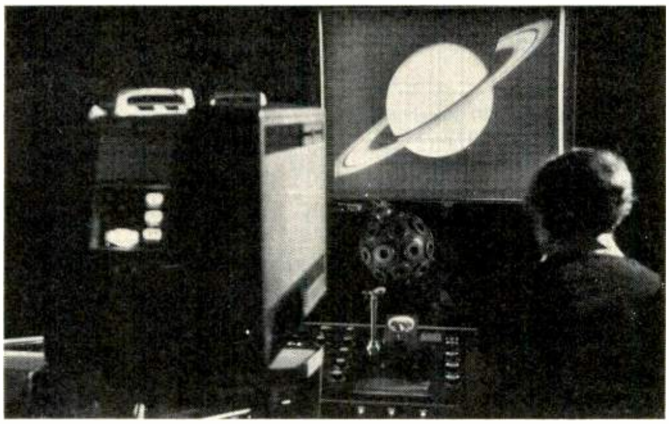
Television Production: Backgrounds for news programs, special effects, data display, program previewing.

Call or write: General Electric Company, Video Display Equipment Operation, Electronics Park 6-206, Syracuse, NY 13221. Phone: (315) 456-2152.

NEWS BACKGROUND at WTMJ-TV, Milwaukee, is displayed rear screen by General Electric projector.



SELL-OUT CROWDS at Fiske Planetarium, Boulder, watched live NASA transmission presented by General Electric projector.

GE Professional Large Screen Television Projector Specifications

Model	Light Output in Lumens			Resolution* in TV Lines per Picture Height		Input Power Req.		Scan Standards***	Video Input**
	Open Gate, Min.	Modulated TV, Min.	Modulated TV, Typ.	Min. Horiz.	Min. Vert.	Watts	Volt-Amps.		
COLOR PROJECTORS									
PJ 5000	550	220	280	750	300	1200	1600	525 li./60 fps; 625 li./50 fps	(1)
PJ 5050	1250	500	650	750	300	1600	2150	525 li./60 fps; 625 li./50 fps	(1)
PJ 5800	550	200	280	750	600	1200	1600	875 lines, 60 fps	(2)
PJ 5850	1250	500	650	750	600	1600	2150	875 lines, 60 fps	(2)
PJ 5100	550	200	280	750	650	1200	1600	1023 lines, 60 fps	(2)
PJ 5150	1250	500	650	750	650	1600	2150	1023 lines, 60 fps	(2)
MONOCHROME PROJECTORS									
PJ 7000	1000	600	750	800	400	1000	1350	525 li./60 fps; 625 li./50 fps	(3)
PJ 7050	1700	1000	1250	800	400	1000	1350	525 li./60 fps; 625 li./50 fps	(3)
PJ 7055	3300	2000	2400	800	400	1500	2000	525 li./60 fps; 625 li./50 fps	(3)
PJ 7800	1000	600	750	800	650	1000	1350	875 lines, 60 fps	(3)
PJ 7850	1700	1000	1250	800	650	1000	1350	875 lines, 60 fps	(3)
PJ 7855	3300	2000	2400	800	650	1500	2000	875 lines, 60 fps	(3)
PJ 7100	1000	600	750	800	750	1000	1350	1023 lines, 60 fps	(3)
PJ 7150	1700	1000	1250	800	750	1000	1350	1023 lines, 60 fps	(3)
PJ 7155	3300	2000	2400	800	750	1500	2000	1023 lines, 60 fps	(3)

Line Power, All Projectors: 117 or 240 v., ± 10%, 50/60 Hz
*Resolution measurements made with wide-band video input.
**Video Input Key: (1) NTSC or RGB. (2) RGB. (3) Wide-Band.
***For use at other scanning rates, contact General Electric (VDEO) for special application/model information.

GENERAL ELECTRIC

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A

AB Systems Inc., Box 754, Folsom, CA 95630

ADC Magnetic Controls, 4900 West 78th St., Minneapolis, MN 55435

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M.A. Shields; Rick Fisher (313) 524-2100

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AMP Inc., Box 3608, Harrisburg, PA 17105

A & S Case Co., 1111 N. Gordon St., Hollywood, CA 90038

ATI-Audio Technologies Inc., 328 W. Maple Ave., Horsham, PA 19044

Ed Mullin (215) 443-0330

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Audiotechniques, 652 Glenbrook Rd., Stamford, CT 06906 (203) 359-2312 Michael Faulkner
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Beattie & Assoc., 3317 Barrow Hill Trail, Tallahassee, FL 32312 (904) 893-1382 Bob Beattie
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John J. Harding Co., 2825 Valena St., Honolulu, HI 96819 (808) 836-0941 Bob Edmondson
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Recording Consultants Inc., 8550 Second Ave., Silver Spring, MD 20910 (301) 587-1800 Tom Williams
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Cramer Video/Audio Systems, 120 Hampton Ave., Needham, MA 02194 (617) 449-2100 Bill Louis
PRS, Inc., Professional Recording & Sound, 1616 Soldiers Field Rd., Boston, MA 02135 (617) 254-2110 Peter Engel
Audio Broadcast Group Inc., 2342 Division Ave., S., Grand Rapids, MI 49507 (616) 452-1596 Dave Veldsma
Sound Solutions Inc., 5701 Canton Center Rd., Canton, MI 48187 (313) 453-6586 Dave Hill
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Audio Associates Inc., 1544D Catasauqua Rd., Bethlehem, PA 18018 (215) 865-6013 Art White
Pro Com Systems, 5001 Baum Blvd., Pittsburgh, PA 15213 (412) 471-6220 Norman J. Cleary
Broadcast Equipment & Supply Co., P.O. Box 3141, Bristol, TN 37620 (615) 878-2531 Clifton Droke
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Linrose Electronics, 202 W. Nakoma, San Antonio, TX 78216 (512) 342-8849 Toby Tobias
SAVCO, P.O. Box 427, Richardson, TX 75080 (214) 234-1841 Nathan Hughes
Alpha Audio, 2049 W. Broad St., Richmond, VA 23220 (804) 358-3852 Dave Jones
David Green Broadcast Consultants, P.O. Box 590, Leesburg, VA 22075 (703) 777-8660 David Green
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Acrodyne Industries Inc., 516 Township Line Rd., Blue Bell, PA 19422

John Parke (215) 542 7000

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ADDA Corp., 1671 Dell Ave., Campbell, CA 95008

Advance Industries, Inc., 2301 Bridgeport Dr., Sioux City, Iowa 51102

Advance Products Co., Box 2178, Wichita, KS 67201

Advanced Analog Systems, Inc., 790 Lucerne Dr., Sunnyvale, CA 94086

Advanced Designs Corp., 38-A Eastview Ave., Bloomfield, IN 47424

Advanced Music Systems, Wallstreams Lane, Worstorne, Burnley, Lancs, England

Advancing Technology Corp., 27106 46th Ave. So., Kent, WA 98031

Agfa-Gevaert Inc., Magnetic Tape Div., 275 N. Street, Teterboro, N.J. 07608

Peter Albrecht Corp., 325 E. Chicago St., Milwaukee, WI 53202

Alco Electronic Products, Inc., 1551 Osgood St., North Andover, MA 01845

Alexander Mfg. Co., Box 1645, Mason City, IA 50401

Alford Mfg. Co., 15 Sixth Rd., Woburn, MA 01801

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Allen Avionics, Inc., 224 E. 2nd St., Mineola, N.Y. 11501

Lester Jacobson (516) 248-8080

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Van Gott & Associates, Inc., 4155 Live Oak, Suite 110, Arcadia, CA 91006 (213) 445-9728
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Reynolds & Associates Inc., 11405 8th St. E., Treasure Island, St. Petersburg, FL 33706 (813) 360-1484
Reynolds & Associates Inc., 5057 Vernon Spring Dr., Atlanta, CA 30338 (404) 393-9113
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Allied Tower Co., Inc., 12450 Old Galveston Rd., Webster, TX 77598

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Amek Systems & Controls Ltd., Islington Mill, James St., Salford, England M3 5HW

American Data Corp., A Div. of Central Dynamics Corp., See also Central Dynamics & Philips Broadcast Group, 401 Wynn Dr. N.W., Huntsville, AL 35805

American Image Productions, Box 23355, Nashville, TN 37202

American Laser Systems, Inc., 106 James Fowler Rd., Goleta, CA 93117

Product Directory begins on page 130

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KY 2700 ACH 3-Tube Saticon Head	4680.
KY 2700AP 3-Tube Sat. for ENG/EFP	5790.
KY 2700AS 3-Tube Sat. for Studio	5390.
GX-S9U Saticon, 6:1 Power zoom, Stereo Audio	785.
Sony	
DXC-1640 w/lens, viewfinder & case	1000.
DXC-1800H head with VTR cable	2670.
DXC-6000L 3-Tube Saticon system. Lens option	8735.
Panasonic	
WV-3150 Newvicon; 6:1 Power zoom w/macro	830.
WV-3160 Newvicon; 12:1 Power zoom w/macro	970.
WV-3400/6X Saticon; 6:1 Power zoom w/macro	910.
WV-3400AF Saticon; 6:1 Power zoom w/macro & auto focus	1040.
WV-3400/12X Saticon; 12:1 Power zoom w/macro	1070.
WV-3890 Saticon; 6:1 Power zoom; 6 or 12 dB gain.	1730.
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WV-777X 3-Saticon, prism optics w/o Lens	4695.
WV-777 As above w/12:1 Lens	5570.
PK-751 Vidicon; 6:1 Motorized zoom w/macro	649.
PK-756 As above with Auto-focus	775.
PK-771 Vidicon, 12:1 Motorized zoom w/macro	760.
PK-802 Saticon, 6:1 Motorized zoom; 5.1 lbs.	810.
PK-956 Newvicon, 6:1 Motorized zoom Auto focus	960.

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Panasonic NV-8110 Player	570.
Panasonic NV-8170 Player	890.
Panasonic NV-1300 3-speed Rec.	750.
Panasonic NV-8350 4-head w/noiseless slo-motion	995.
Panasonic NV-8200 Solenoid Recorder	1100.
Panasonic NV-8950 3-speed front load, w/stereo sound	1420.
Panasonic NV-8420 Portable	720.
JVC HR-2650U Portable w/stereo sound	805.
JVC HR-7300U Program. w/shuttle search	650.
JVC HR-7650U Stereo sound w/front load	1050.
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12" Sony CVM-1250 Rec./Mon.	620.
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Amilon Corp., 49-12 30th Ave., Woodside, NY 11377

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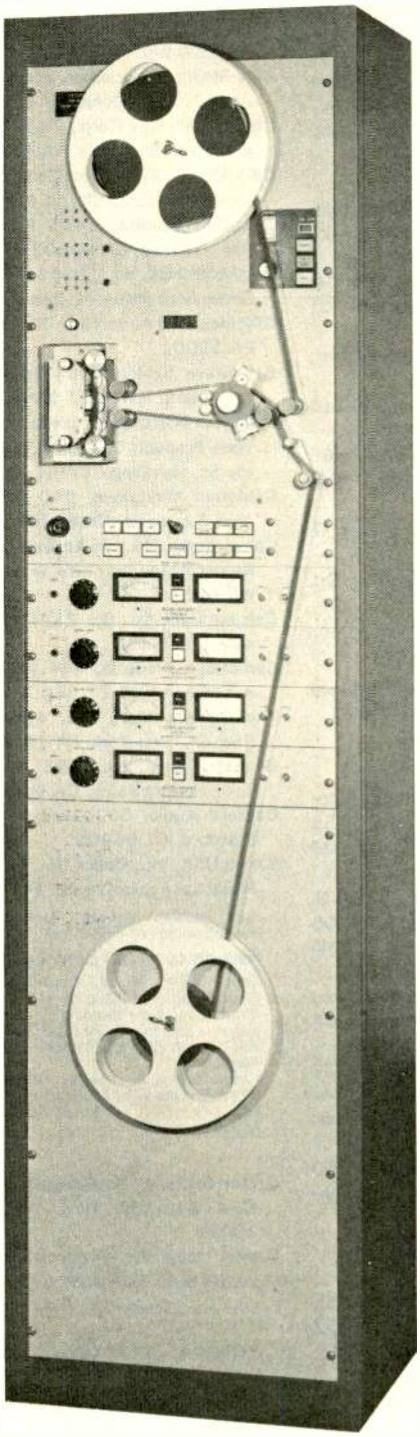

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AVAB America Inc., 967 Howard St., San Francisco, CA 94103
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R. M. Associates, Ltd., 11503 West 7th St., Shawnee Mission, KS 66214 (913) 631-7606 Mike Eakins
Robert Milsk Co., 22420 Telegraph Rd., Southfield, MI 48034 (313) 354-3310 Chuck Milsk
Skor, 1821 University Ave., St Paul, MN 55104 (612) 645-6461 Gener Surzweg
J.B. Parent Co., 4701 Clentangy River Rd., Columbus, OH 43214 (614) 459-5947 John Essig
Wilson Audio Sales, Rt. 3, Barrell Springs Hollow Rd., Franklin, TN 37064 (615) 794-0155 Wally Wilson
Dimension Marketing Corp., 9450 Skillman, No. 113, Dallas, TX 75243 (214) 348-9657 Jim Hancock
Dimension Marketing Corp., 5800 Corporate Dr., Suite D6, Houston, TX 77036 (713) 772-0961 Phil Canavespa
Sphere Associates, 11250-14 Roger Bacon Dr., Reston, VA 22090 (703) 471-1230
Matrix Marketing, 7415 Greenwood Ave. N., Seattle, WA 98103 Dough Schauer Cliff Miller
A.C Simmonds and Sons, 975 Dillingham Rd., Pickering, Ont., Canada L1W 3B2 (416) 839-8041 Bud Campion

Cezar International, Ltd., 1026 W. Maude Ave., Sunnyvale, CA 94086

Channelmatic, Inc., 821 Tavern Rd., Alpine, CA 92001

Cherry Elec. Products Corp., 3600 Sunset Ave., Waukegan, IL 60087

John Chiles, Inc., 7622 Main St., Jacksonville, FL 32208

Christie Electric Corp., 20665 Manhattan Pl., Torrance, CA 90501

Chyron Corp., Telesystems, 265 Bethpage/Spagnoli Rd., Melville, NY 11747

Cine 60, Inc., 630 9th Ave., New York, N.Y. 10036

Cinema Products Corp., 2037 Granville Ave., Los Angeles, CA 90025

CineMills Corp., 3500 W. Magnolia Blvd., Burbank, CA 91505

Circuit Research Labs, Inc., 3204 S. Fair Lane, Tempe, AZ 85282

Clear-Com Intercom Systems, 1111 17th St., San Francisco, CA 94107

Cleveland Institute of Elec., Inc., 1776 East 17th St., Cleveland, OH 44114

Coastcom, 2312 Stanwell Dr., Concord, CA 94520

Coherent Communications, 13756 Glenoaks Blvd., Sylmar, CA 91342

Cohu, Inc., Electronics Div., Box 623, San Diego, CA 92112

Colorado Video Inc., Box 928, Boulder, CO 80306

Colorgraphics Weather Systems, Inc., 5727 Tokay Blvd., Madison, WI 53719

Colortran, Inc., 1015 Chestnut St., Burbank, CA 91506

Jeffrey Sessler; Paul Sherbo; Charlie Hurth (213) 843-1200

REGIONAL SALES CONTACTS:

Colortran, Inc., 7909 B Landmark S., Tampa, FL 33615 (813) 886-1377 John J. Gallagher
Colortran, Inc., 380 Riverside Dr., #3D, New York, NY 10025 (212) 222-2140 Jane Head
Colortran, Inc., P.O. Box 19364, Cincinnati, OH 45219 (812) 537-4142 Robin Cross
Colortran, Inc., 3805 Cheyenne Dr., Rowlett, TX 75088 (214) 475-3211 Mel Rimmer

Columbia Special Products, 51 West 52nd St., Room 861, New York, NY 10019

Comark Communications, Inc., Box 267, Southwick, MA 01077

Richard Fiore, Jr.; John Molta (413) 569-0116/5939

REGIONAL SALES CONTACTS:

Allied Broadcast Equipment, 4405 Mall Blvd., Suite 314, Union City, GA 30291 (404) 964-1464 Mark Orummond; John Timm
Allied Broadcast Equipment, 5485 N. Lawler Ave., Chicago, IL 60630 (312) 784-2257 Tom Harle
Allied Broadcast Equipment, 635 South 'E' St., Richmond, IN 47374 (317) 962-8596 David Burns
Audio Media Associates, P.O. Box 29264, New Orleans, LA 70189 (504) 586-0140 Corey Meyer
Southern Coastal Marketing, 6300 Carmel Rd., Charlotte, NC 28202 (800) 438-6040 Bob Cauthen
Allied Broadcast Equipment, 1201 East 15th, Suite 309, Plano, TX 75074 (214) 423-8667 Mr. Pat Hurley; Leon Urban
Allied Broadcast Equipment, 1112 South 344th St., #312, Federal Way, WA 98003 (206) 927-4337 Cal Vandergrift; Fred Harkness

Comark Industries Inc., Box 229, Southwick, MA 01077

REGIONAL SALES CONTACTS:

See Comark Communications, Inc.,

Comex Systems, 2 Columbia Dr., Amherst, NH 03031

Tom Sullivan (603) 889-8564

REGIONAL SALES CONTACTS:

Jack Hawkinson Assoc., 3541 San Pasqual St., Pasadena, CA 91107 (213) 795-7228 Jack Hawkinson
Hoin Assoc., 1201 St. Francis Way, San Carlos, CA 94070 (415) 592-6401 Ed Hoin
Reshal Assoc., 2301 Hammond Dr., Schaumberg, IL 60195 (312) 397-9010 Robert Reese
Sel-Tronics, Inc., 721 Ellsworth Dr., #203, Silver Springs, MD 20910 (301) 589-3391 Chet Paddock
Anderson Assoc., 1109 Airport Circle S., Euless, TX 76039
Del Com Sales, 144 S.W. 153rd St., Seattle, WA 98166 (206) 248-0090 John DelVento

Command Productions, Radio Broadcasting Services, Box 26348, San Francisco, CA 94126

Commerce Airborne Div., IFR Avionics, Inc., 16425 Hart St., Suite 106, Van Nuys, CA 91406

Comm-Scope Co., Box 1729, Hickory, NC 28603

Communitronics Ltd., 160 Wilbur Place, Bohemia, NY 11716

Community Light & Sound, 5701 Grays Ave., Philadelphia, PA 19143

COMPAC, 279 Skidmore Rd., Deer Park, NY 11729

Compact Video Sales, Inc., 1104 W. Chestnut St., Burbank, CA 91506

Composite Video, 1218 N. Blackwelder, Oklahoma City, OK 73106

Comprehensive Video Supply Corp., 148 Veterans Dr., Northvale, NJ 07647

Compucon, Inc., Box 401229, Dallas, TX 75240

Computer Business Systems, Inc., 167 Moore Rd., East Weymouth, MA 02189

Computer Concepts Corp., 8001 West 63rd, Shawnee Mission, KS 66202

Computer Graphics Lab, Inc., 405 Lexington Ave., 59th Floor, New York, NY 10174

Computer Labs, Div. of Analog Devices, Inc., 505 Edwardia Dr., Greensboro, N.C. 27409

Computer Management Systems, Inc., 6610 N. Shadeland Ave., Indianapolis, IN 46220

Computer Operations Inc., 5001-J Forbes Blvd., Lanham, MD 20706

Computer Video Systems, Inc., 3678 W. 2150 So., Unit #2, Salt Lake City, UT 84120

Comrex Corp., 60 Union Ave., Sudbury, MA 01776

Comsearch, Inc., 11503 Sunrise Valley Dr., Reston, VA 22091

ComSonics, Inc., Box 1106, Harrisonburg, VA 22801

Comtech Antenna Corp., Box 428, St. Cloud, FL 32769

Comtech Data Corp., 350 N. Hayden Rd., Scottsdale, AZ 85257

ComWorld Video Services, 9000 E. Church St., Brentwood, TN 37027

Conrac Div., Conrac Corp., 600 North Rimsdale Ave., Covina, CA 91722

Wm. Ems; Warren J. O'Buch, Dir. of Mktg. (213) 966-3511

REGIONAL SALES CONTACTS:

Roh's Inc., 4553 E. Broadway, Tucson, AZ 85711 (602) 795-8573 Wm. Roh
Gen. Electronics Systems, 1440 San Pablo Ave., Berkeley, CA 94702 (415) 527-7700 Rick Riegler
Tri-Tronics Inc., 2921 W. Alameda Ave., Burbank, CA 91505 (213) 843-2170 Michael Purdy
Omega Video Inc., 14326 Isis Ave., Lawndale, CA 90260 (213) 679-9021 Rick Riegler
Davis Audio/Visual Inc., 1801 Federal Blvd., Denver, CO 80204 (303) 455-1122 Ted Vindiola
Scientific Systems, Inc., 43 Main St., Bailey, CO 80421 (303) 838-4615 Ronald Carter
Conrac Univ., 3 Landmark Square, Stamford, CT 06901 (203) 348-2100 Richard Spallone
Midwest Corp., 3331 N.W. 82nd Ave., Miami, FL 33122 (305) 592-5355 Wm. Dancy
Electronic Equipment, Inc., 526 Plaster Ave., N.E., Atlanta, GA 30324 (404) 873-5842 Joe Faust
Meade Electric Co., 3100 South 25th Ave., Broadview, IL 60153 (312) 344-4174 Wm. Richie
Swiderski Electronics Inc., 1200 Greenleaf Ave., Elk Grove Village, IL 60007 (312) 364-1900 Mark Swiderski
Conrac Div., 381 N. York Rd., Elmhurst, IL 60126 (312) 833-3310 John Keenan
Midwest Corp., 4700-G Boston Way, Lanham, MD 20801 (301) 577-4903 Ed Sammerville
Conrac Div., 6 New England Executive Park, Burlington, MA 01803 (617) 272-6720 Edward Colby
QSI Systems, Inc., 12 Linscott Rd., Woburn, MA 01888 (617) 938-1403 Richard Smilgis
Emmons Associates, Inc., 1121 Riverwood Dr., Burnsville, MN 55337 (612) 890-8920 Keith Emmons
Television Engineering Corp., 580 Goddard Ave., Chesterfield, MO 63017 (314) 532-4700 Wm. Vines
Tele-Measurements, Inc., 145 Main Ave., Clifton, NJ 07014 (201) 473-8822 Wm. Endres
Sonocraft Corp., 360 West 31st St., 10th Flr., New York, NY 10001 (212) 760-9300 Fred Lissa
KAVCO Inc., 3931 Image Dr., Dayton, OH, 45414 (513) 898-2003 Richard Klopf
Midwest Corp., 1150 C West 8th St., Cincinnati, OH 45203 (513) 651-1904 George Bates
Lerro Electrical Corp., 3125 N. Broad St., Philadelphia, PA 19132 (215) 223-8200 Louis Lerro
Peirce-Phelps, Inc., 2000 North 59th St., Philadelphia, PA 19131 (215) 879-7171 Vic Broody
RPC Electronics, 620 Alpha Dr., Pittsburgh, PA 15238 (412) 782-3770 Sam Liptak
Broadcast Systems, Inc., 8222 Jamestown, A103, Austin, TX 78758 (512) 836-6014 Donald Forbes
Industrial Audio/Video, 2167 Bissonnet, Houston, TX 77005 (713) 524-1956 David Patton
MZB & Associates, 4203 Beltway Dr., Dallas, TX 75234 (214) 233-5535 Richard Bock
Skaggs Video Sales, 4865 Wiley Post Way, Salt Lake City, UT 84116 (801) 539-1420 Sam Kichas
Robert Slye Electronics, Inc., 3415 N. Washington Blvd., Arlington, VA 22201 (703) 525-7272 Robert Slye
North-West Industries, 5518 Empire Way, Seattle, WA 98118 (206) 722-7400 J. Stanton Keck
Conrac Div., 345 Kingston Rd., Suite 210, Pickerring, Ont., Canada L1V 1A1 (416) 286-2294 Brian Mitchell
Glentronix Ltd., 160 Duncan Mill Rd., Don Mills, Ont., Canada M3J 1Z5 (416) 444-8497 Tom Pressly
Meritron Ltd., 115 St. Regis Cr. N., Downview, Ont., Canada M3J 1Y9 (416) 635-9456 D'Alton Jolly
Nortec West Ltd., 325 West 5th Ave., Vancouver, BC, Canada V5Y 1J6 (604) 872-8525 Robert Whitehouse

Contel Mfg. Div. of Continental Elec. Wholesale Corp., 1620 W. 32nd Place, Hialeah, FL 33012

Continental Electronics Mfg. Co., Box 270879, Dallas, TX 75227

R. L. 'Dick' Floyd (214) 381-7161

REGIONAL SALES CONTACTS:

Dave Hultsman, 2280 Rockcreek Trail, Birmingham, AL 35226 (205) 822-1078
Steve Keating, 7225 Hollywood Blvd., Suite 105, Hollywood, CA 90046 (213) 851-6380
John D. Abdnour, P.O. Box 575, Streator, IL 61364 (815) 672-8585
Jim Littlejohn, 670 N. Branch Rd., Maple Plain, MN 55359 (612) 479-2633
Lloyd W. Collins, Rt. 3, Box 106, Holts Summit, MO 65043 (314) 896-5791
Mark F. Hutchins, P.O. Box 13, Greenland, NH 03840 (603) 436-4059
Keith A. Leach, P.O Box 16, Newton, NJ 07860 (201) 383-8797
Tom T. Cauthers, 1215 Southeast 73rd Ave., Portland, OR 97215 (503) 254-2818
Ray C. Evans, P.O. Box 143, Alcoa, TN 37701 (615) 970-2572
Steven H. Schott, P.O. Box 2008, Plano, TX 75074 (214) 423-3644

Continental Recordings Inc., 210 South St., Boston, MA 02111

Control Video Corp., 578 Division St., Campbell, CA 95008

Controlonics Corp., Box 555, Westford, MA 01886

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Convergence Corp., 1641 McGaw, Irvine, CA 92714

Cool Light Co., Inc., 5723 Auckland Ave., No. Hollywood, CA 91601

Cortland Cable Co., Box 352, Cortland, NY 13045

Cosmin Electronics, 4214 San Pedro Ave., San Antonio, TX, 78212

Countryman Associates Inc., 417 Stanford Ave., Redwood City, CA 94063

Crosspoint Latch Corp., 95 Progress St., Union, NJ 07083

George Pires, Pres. (201) 688-1510

Crouse-Hinds Co., Box 4999, Syracuse, N.Y. 13221

Crown International, Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517

James Beattie (219) 294-5571

REGIONAL SALES CONTACTS:

Marshank Sales Co., 3940 Higuera St., Culver City, CA 90230 (213) 559-2591 Norm Marshank

J.N.D., 462 Cascade Dr., P.O. Box 606, Fairfax, CA 94930 (415) 459-3186 John Frigaard

Audities 2001, 2377 E. Mississippi Ave., Denver, CO 80210 (303) 777-4595 Mike Cluphl

Bencsik Associates, Inc., 1677 E. Silver Spring Blvd., Suite F, Oscala, FL 32670 (904) 732-9775 Wm. Bencsik

Elrep Sales Co., 4508 Bibb Blvd., B-4, Tucker, GA 30084 (404) 938-7108 Ben VanDeKreke

Prorep Hawaii, 1346 Makaikoa St., Honolulu, HI 96921 (808) 732-0639 Gary Nahanishi

Audio Resources, 825 N. Cass Ave., Westmont, IL 60559 (312) 655-1180 Wayne Hrabak

VF Sales, 181 Worcester Rd., Suite 9, Natick, MA 01760 (617) 237-6544 Vic Faucon

Fruen & Associates, 17620 Copperwood Lane S., Wayzata, MN 55391 (612) 475-2642 Bill Fruen

R. J. Throckmorton, 124 Manchester Rd., P.O. Box 1038, Ballwin, MO 63011 (314) 227-7222 Ron Throckmorton

Overhauser Marketing Association, 733 James Lane, Incline Village, NV 89450 (702) 831-3174 Bill Overhauser

Metrorep, 57 South St., P.O. Box 782, Freehold, NJ 07728 (201) 462-1221 Sam Helms

Darmstedter Associates, 41 R. Oswego St., Baldwinsville, NY 13027 (315) 638-1261 Bernard Darmstedter

Audio Marketing Association, 9470 Whitewood Rd., Brecksville, OH 44141 (216) 526-2426 Bruce Hagen

Dobbs-Stanford Corp., 2715 Electronic Lane, Dallas, TX 75220 (214) 358-0800 Fred Dobbs

Northshore Marketing, 1800 N.E. 75th St., Seattle, WA 98115 (206) 624-8672 Lew Barrett

Cumming Corp., 8714 Woodley Ave., Sepulveda, CA 91343

Custom Business Systems, Inc., Box 67, Reedsport, OR 97467

D

db Cassette, Katarinavagen 20, 11645 Stockholm, Sweden

D-B Electronics, Inc., 7851 Airpark Dr. #201, Gaithersburg, MD 20760

dbx, Inc., 71 Chapel St., Newton, MA 02195

DHV, Inc., Box 520, Mineral Wells, TX 76067

D.O. Industries, Inc., 317 E. Chestnut St., East Rochester, NY 14445

Peter W. Dahl Co., Inc., 4007 Fort Blvd., El Paso, TX 79930

Peter W. Dahl (915) 566-5365

Da-Lite Screen Co., Inc., 3100 State Rd. 15 N., Warsaw, IN 46580

Dalsat, Inc., Box 1960, Plano, TX 75074

Data Communications Corp., Broadcast Div., 3000 Directors Row, Suite 508, Memphis, TN 38131

Datametrics Inc., 340 Fordham Road, Wilmington, MA 01887

Datatek Corp., 1121 Bristol Rd., Mountainside, NJ 07092

Datatron, Inc., 2942 Dow Ave., Tustin, CA 92680

Frank Logan (714) 544-9970

Datatronix, Inc., 2100 Reston Ave., Reston, VA 22091

Dataworld Inc., 1302 18th St. N.W., Suite 502, Washington, DC 20036

Datel-Intersil Inc., 11 Cabot Blvd., Mansfield, MA 02048

Datum Inc., 1363 S. State College Blvd., Anaheim, CA 92806

Delta Electronics Inc. (N.C.), 145 Fayette St., Winston Salem, N.C. 27101

Delta Electronics Inc. (VA), 5730 Gen. Washington Dr., Alexandria, VA 22312

R.G. Bousman (703) 354-3350

Deltamod Corp., 2823 Ninth St., Berkeley, CA 94710

Douglas Maisel (415) 548-4858

REGIONAL SALES CONTACTS:

Recording & Broadcast Supply, 802 Fourth St., San Rafael, CA 94901 (415) 457-7566 John Sugnet

Allied Broadcast Equipment, 4405 Mall Blvd., Suite 314, Union City, GA 30291 (404) 964-1464 Mark Drummond; John Timm

Allied Broadcast Equipment, 635 South E St., Richmond, IN 47374 (317) 962-8596 Dave Burns

Allied Broadcast Equipment, 1201 E. 15th, Chaddick Ctr., Suite 309, Plano, TX 75074 (214) 423-8667 Pat Hurley

Allied Broadcast Equipment, 1112 South 344th St., Suite 312, Federal Way, WA 98003 (206) 927-4337 Fred Harkness; Cal Vandegrift

Denrad Technical Group, P.O. Box 225, Denison, TX 75020

Design Line Inc., 6204 Benjamin Rd. #209, Tampa, FL 33614

Devlin Productions, Inc., 150 West 55th St., New York, NY 10019

De Wolfe Music Library, 25 West 45th St., New York, NY 10036

Dictaphone Corp., 120 Old Post Rd., Rye, NY 10580

Dielectric Communications, A Unit of General Signal, Route 121, Raymond, ME 04071

Digital Video Systems Inc., 716 Gordon Baker Rd., Willowdale, Ont., Canada M2H 3B4

David Codling-US; J. Gerkes-Canada (416) 499-4826

REGIONAL SALES CONTACTS:

Electro Systems Engineering, 2606 Roxbury Lane, Forth Smith, AR 72903 (501) 646-7111

Tritronics Inc., 2921 W. Alameda Ave., Burbank, CA 91505 (213) 843-2170 C. Huber

Technical Video Inc., 2035 Will Ross Ct., Atlanta, GA 30341 (404) 458-1587 Mike Monk

PVS Inc., 1616 Soldiers Field, Boston, MA 02135 (617) 254-2101 Doug Sorenson

Turner Engineering, 14 Morris Ave., Mountain Lakes, NJ 07046 (201) 263-0023 John Turner, Jr.

Digital Video Systems, Inc., 2 Penn Plaza, New York, NY 10121 (212) 695-5311 Robt. Mcall

Sonocraft Corp., 360 West 31st St., 10th Flr., New York, NY 10001 (212) 760-9300 B. Palmer

Midwest Corp., 1021 West 8th St., Cincinnati, OH 45203 (513) 651-1904 J. Adrick

Victor Duncan Inc., 2659 Fondren, Dallas, TX 75206 (312) 943-7300

Vid Com Ltd., 1995 Boundary Rd., Vancouver, BC, Canada (604) 291-6061 Rupert Bent

Western Cinevision, 5838 Burbank Rd., S.E., Calgary, Alta. Canada (403) 253-0351 Andy Lemont

Dilor Industries Ltd., Box 2169, Squamish, BC, Canada V0N 3G0

Discom Satellite Systems, Inc., Box 8699, Independence, MO 64054

Discwasher, Box 6021, Columbia, MO 65205

Ditch Witch, The Charles Machine Works, Inc., Box 66, Perry, OK 73077

Di-Tech Inc., 48 Jefryn Blvd., Deer Park, NY 11729

Dolby Laboratories, Inc., 731 Sansome St., San Francisco, CA 94111

Tim Prouty (415) 392-0300

Dorrough Electronics, 5221 Collier Place, Woodland Hills, CA 91364

DowKey Div., Of Kilovac Corp., Box 4422, Santa Barbara, CA 93103

The Drop Shop Ltd., Roselle, NJ 07203

D'San Corp., 25-30 163rd St., Flushing, NY 11358

Dubner Computer Systems, Inc., 158 Linwood Plaza, Ft. Lee, NJ 07024

Ivan Maltz (201) 592-6500

Dukane Corp., Audio-Visual Div., 2900 Dukane Dr., St. Charles, IL 60174

Duncan Electronics, Inc., 2865 Fairview Road, Costa Mesa, CA 92626

E. I. du Pont de Nemours & Co., Inc., Product Information, 1007 Market St., Wilmington, DE 19898

The Durafilm Co., 137 N. LaBrea Ave., Hollywood, CA 90036

DYMA Engineering, Inc., Box 1697, Taos, NM 87571

Dynair Electronics, Inc., 5275 Market St., San Diego, CA 92114

Robert A. Jacobs (714) 263-7711

Dynamic Technology Ltd., Zonal House, Alliance Rd., West Action, London, England W3 0BN

Dynamote Corp., 1200 W. Nickerson, Seattle, WA 98119

Dynatech Data Systems, 7644 Dynatech Ct., Springfield, VA 22153

Dynatech/U-Z, Inc., 589 Venice Blvd., Venice, CA 90291

E

EECO Inc., 1601 E. Chestnut Ave., Santa Ana, CA 92701

Geo. Swetland, Mktg. Mgr., Video Products (714) 835-6000

REGIONAL SALES CONTACTS:

Hoffman Video Systems, 800 W. Pico Blvd., Los Angeles, CA 90015 (213) 749-3311 Jim Peacher; Ken Williamson

Ampex (Domestic Hdqtrs), 401 Broadway, Redwood City, CA 94063 (415) 367-2011

Swiderski Electronics Inc., 1200 Greenleaf Ave., Elk Grove Village, IL 60007 (312) 364-1900 Joseph Swiderski III

Professional Products, Inc., 4964 Fairmont Ave., Bethesda, MD 20814 (301) 657-2141 Philip Bolten

Lake Systems Corp., 55 Chapel St., Newton, MA 02160 (617) 244-6881 Walter Kelley

A.F. Associates, Inc., 100 Stonehurst Court, Northvale, NJ 07647 (201) 767-1000 Bill Ebell

Harvey Professional Audio, 25 West 45th St., New York, NY 10036 (212) 921-5920 Dan Mazur; Gene Perry

Lerro Electrical Communication, Electronic System Div., 3125 N. Broad St., Philadelphia, PA 19132 (215) 223-8200 Louis Lerro

MZB & Associates, 4203 Beltway, Dallas, TX 75234 (214) 233-5535 Rich Hajdu

Custom Video Systems, Inc., 17521 14th Ave. N.E., Seattle, WA 98155 (206) 365-5400 Al Harwood

EEG Enterprises, Inc., 1 Rome St., Farmingdale, NY 11735

EEV, Inc., 7 Westchester Plaza, Elmsford, N.Y. 10523

Tom Soldano, RF Products; Charles Shellenberg-Imaging Products (914) 592-6050

REGIONAL SALES CONTACTS:

EEV, Inc., 15 Dunwoody Park, Suite 100E, Atlanta, GA 30338 (404) 394-9201 Harry Kozicki

EEV, Inc., 2073 Arleen Court, Schaumburg, IL 60194 (312) 843-8417 Chuck Bocan

EEV, Inc., Elmsford, NY (914) 592-6050 Gary Chapman

EEV, Inc., 250 Hamilton Dr., Synder, NY 14226 (716) 839-5959 Rick Bossert

EEV, Inc., Route 1, Anna, TX 75003 (214) 837-2464 Bob Knowles

EEV, Inc., 19001 40th Place N.E., Seattle, WA 98155 (206) 363-2200 Don Rose

EEV, Canada Ltd., 67 Westmore Dr., Rexdale, Ont. Canada M9V 3Y6 (416) 745-9494 Bob Parkes

English Electric Valve Co. Ltd., Waterhouse Lane, Chelmsford England CM1 2QU (0245) 61777 Mark Knight

EEV Canada Ltd., 67 Westmore Dr., Rexdale, Ont., Canada M9V 3Y6

EG&G Inc., 35 Congress St., Salem, MA 01970

EMCEE Broadcast Products, Box 68, White Haven, PA 18661

David Parmelee (717) 443-9575

EMT-FRANZ GMBH, Postfach 1520, D-7630 Lahr, West Germany

E-N-G Corp., Electronic News Group, Box 367, Concord, CA 94518

ENG Helicopter Satellites, Ltd., 9919 Carter Rd., Bethesda, MD 20817

ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. 07650

ESE, 142 Sierra St., El Segundo, CA 90245

R. M. Mayers (213) 322-2136

REGIONAL SALES CONTACTS:

Pro Video Systems, 240 Oxmoor Circle, Birmingham, AL 35209 (205) 942-7904 Bill Waterhouse

Allied Broadcast Equipment, 635 South E St., Richmond, IN 47374 (317) 962-8596 Dave Burns

David Bain Associates, 11 Orchard Farm Rd., Port Washington, NY 11050 (516) 883-4818 David Bain

Technical Video Systems, 215 N. Broad St., Winston-Salem, NC 27101 (919) 748-0916 Paul Michael

KAVCO, 3381 Successful Way, Dayton, OH 45414 (513) 236-5500 Russell Johnson

Midwest Corp., 1021 West 8th St., Cincinnati, OH 45203 (513) 651-1904

Lerro Electrical, 3125 N. Broad St., Philadelphia, PA 19132 (215) 223-8200 Louis Lerro

David Green Broadcast Consultant, 21 N. Wirt St., Leesburg, VA 22075 (703) 777-8660 David Green

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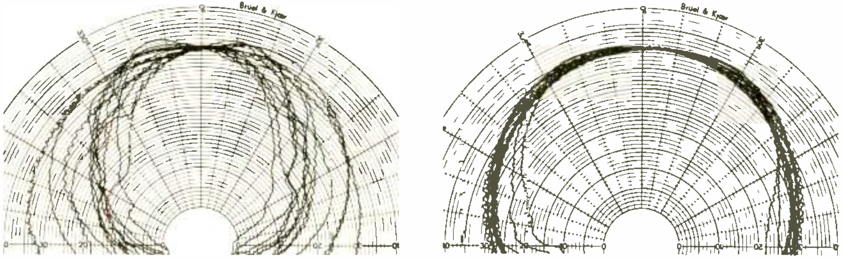
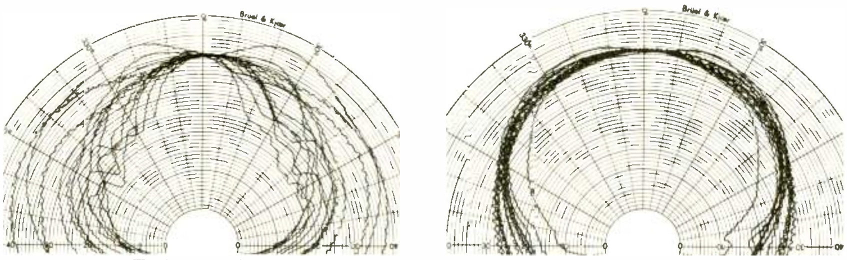
Before you invest in new studio monitors, consider all the angles.

Polar response comparison of a typical two-way coaxial studio monitor and JBL's new 4430 Bi-Radial studio monitor from 1 kHz to 16 kHz.



Typical horizontal

JBL 4430 horizontal



Typical vertical

JBL 4430 vertical

No one has to tell you how important flat frequency response is in a studio monitor. But if you judge a monitor's performance by its on-axis response curve, you're only getting part of the story.

Most conventional monitors tend to narrow their dispersion as frequency increases. So while their on-axis response may be flat, their off-axis response can roll off dramatically, literally locking you into the on-axis "sweet spot." Even worse, drastic changes in the horn's directivity contribute significantly to horn colorations.

Introducing the JBL Bi-Radial Studio Monitors.

At JBL, we've been investigating the relationship between on and off axis frequency response for several years. The result is a new generation of studio monitors that provide flat response over an exceptionally wide range of horizontal and vertical angles. The sweet spot and its traditional restrictions are essentially eliminated.

The key to this improved performance lies in the unique geometry of the monitors' Bi-Radial horn.[1] Developed with the aid of the latest computer design and analysis techniques, the horn provides constant coverage from its crossover point of 1000 Hz to beyond 16 kHz. The Bi-Radial compound flare configuration maintains precise control of the horn's wide 100° x 100° coverage angle.

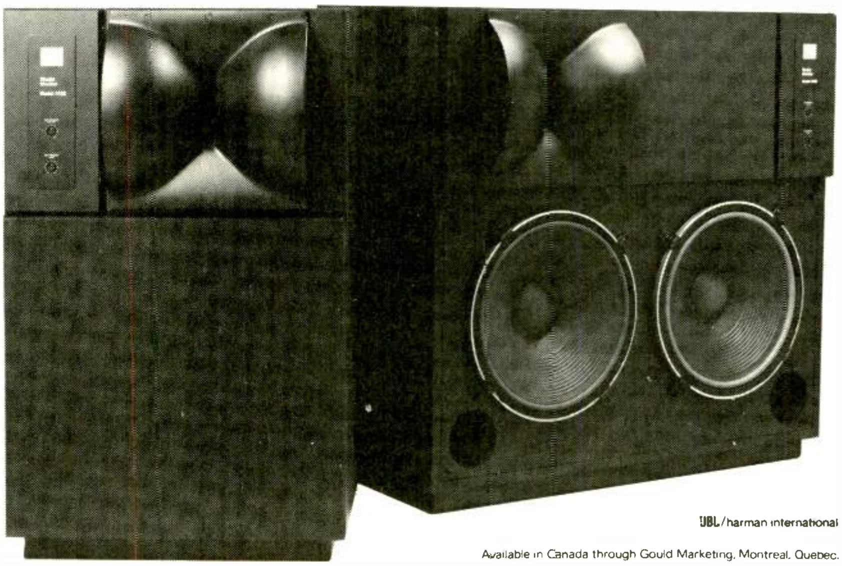
And the Bi-Radial horn's performance advantages aren't limited to just beamwidth control. The horn's rapid flare rate, for instance, dramatically reduces second harmonic distortion and its shallow depth allows for optimal acoustic alignment of the drivers. This alignment lets the monitors fall well below the Blauert and Laws criteria for minimum audible time delay discrepancies.

But while the Bi-Radial horn offers outstanding performance, it's only part of the total package. The new monitors also incorporate JBL's most advanced high and low frequency transducers and dividing networks. Working together, these components provide exceptionally smooth response, high power capacity, extended bandwidth, and extremely low distortion.

Judge For Yourself

Of course, the only way to really judge a studio monitor is to listen for yourself. So before you invest in new monitors, ask your local JBL professional products dealer for a Bi-Radial monitor demonstration. And consider all the angles.

James B. Lansing Sound, Inc.
8500 Balboa Boulevard
P.O. Box 2200
Northridge, California 91329 U.S.A.



JBL/harman international

Available in Canada through Gould Marketing, Montreal, Quebec.

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[1] Patent applied for.

JBL Professional Products Division

Circle (144) on Reply Card

EXR Corp., 3373 Oak Knoll, Brighton, MI 48116

East Coast Sound Inc., 40 Main St., Danbury, CT 06810

Eastern Acoustic Works Inc., Box 111, So. Framingham, MA 01701

Eastern Air Lines, Inc.

Eastman Kodak Co., 343 State St., Rochester, N.Y. 14650

ECHOlab, Inc., 175 Bedford Rd., Burlington, MA 01803

Econco Broadcast Service Inc., 1302 Commerce Ave., Woodland, CA 95695

Edcor, 16782 Hale Ave., Irvine, CA 92714

Ednalite Corp., 200 N. Water St., Peekskill, NY 10566

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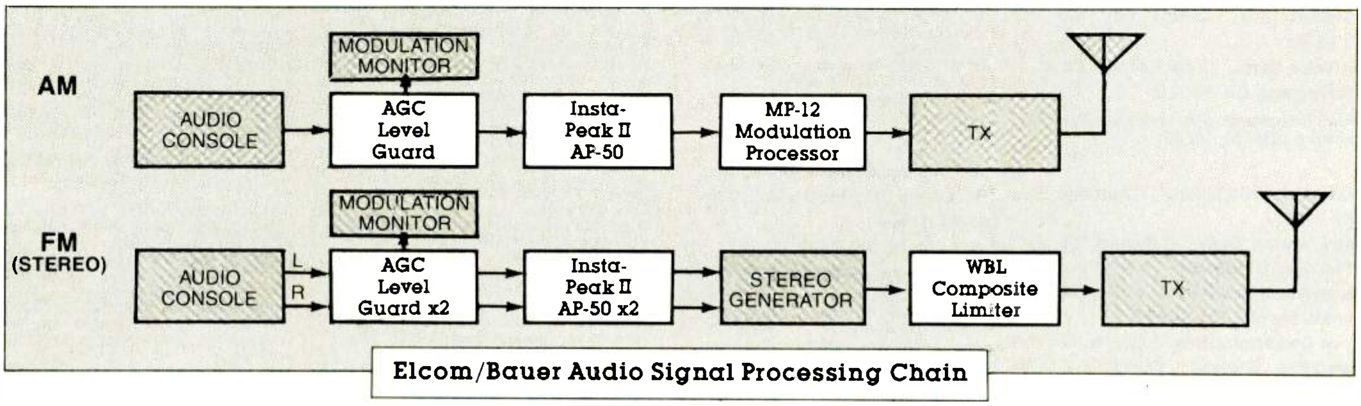

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The MP-12 Modulation Processor

Increases the positive modulation from an AM transmitter by means of controlled negative feedback which yields low distortion, asymmetrical modulation. Negative modulation peaks are held below 100%, eliminating the need for peak clipping.

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The WBL Composite Limiter

Can be adjusted to provide continuous 100% modulation with any existing transmitter combination and eliminates all filter and preemphasis overshoot. It provides long term stability and complete agreement between the modulation meter and peak flasher while increasing FM modulation up to 40%.

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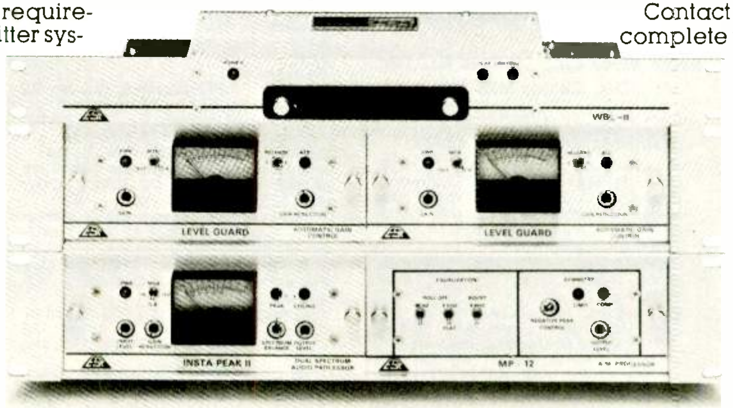

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David Lint Associates Inc., 3350 Scott Blvd., Bldg. 5, Santa Clara, CA 95051

Lipsner-Smith Co., 4700 Chase Ave., Lincolnwood, IL 60646

Listec TV Equipment Corp., 39 Cain Dr., Plainview, NY 11803

Jon Bart (516) 694-8963

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REGIONAL SALES CONTACTS:

Listec (West) Corp., 1619 Cosmic Way Glendale CA 91201 (213) 247-9247 Howard Stucker

Live Sound Inc., 1741 N. Ivar, Suite 118, Hollywood, CA 90028

Logica Inc., 666 Third Ave., New York, NY 10017

Logitek Electronic Systems, Inc., 3320 Bering Dr., Houston, TX 77057

Loral Microwave Communications, Terracom, 9020 Balboa Ave., San Diego, CA 92123

Lowel-Light Mfg., Inc., 475 Tenth Ave., New York, NY 10018

Lowenthal Mfg. Co., 2076 N. Elston, Chicago, IL 60614

Lumitrol, Ltd., 5 Walker Ave., Toronto, Ont., Canada M4V 1G3

Lyon Lamb Video, Animation System, 8255 Beverly Blvd., Los Angeles, CA 90048

M

M/A-Com Microwave Power Devices, 330 Oser Ave., Hauppauge, NY 11788

M/A-Com DCC, Inc., 11717 Exploration Lane, Germantown, MD 20874

M/A Comm/Scope, Box 1729, Hickory, NC 28603

MBI Broadcast Systems, 69 Ship St., Brighton, England BN1 1AE

MCG Electronics Inc., 160 Brook Ave., Deer Park, NY 11729

MCI, A Div. of the Sony Corp. of America, 1400 W. Commercial Blvd., Ft. Lauderdale, FL 33309

Dennis Sindrey (305) 491-0825

REGIONAL SALES CONTACTS:

Audio Industries Corp., 1419 N LaBrea Ave., Hollywood, CA 90028 (213) 851-4111
Pacific Recorders & Eng. Corp., 11100 Roselle St., San Diego, CA 92121 (714) 453-3255
Audiotechniques Inc., 652 Glenbrook Rd., Stamford, CT 06906 (203) 359-2312
Pro Audio General Store, Inc., 1378 Northwest 100th Ave., Coral Springs, FL 33065 (305) 752-0330 William G. Shute
Control Technology, Inc., 2322 Davie Blvd., Ft Lauderdale, FL 33312 (305) 587-2716
Recording Studio Eequip. Co., 14205 N E 18th Ave., North Miami Beach, FL 33182 (305) 949-8918
Milam Audio Co., 1470 Valle Vista Blvd., Pekin, IL 61554 (309) 346-3161 Jerry Milam
Audiotechniques, Inc., 8306 Still Spring Court, Bethesda, MD 20817 (301) 469-7500
Studioworks, 1018 Central Ave., Charlotte, NC 28204 (704) 375-1053
MCI, Inc./Nashville Office, Nashville Commerce Mall, Suite B-9, 1717 Elm Hill Pike, Nashville, TN 37210 (615) 366-0333
Southwest Professional Audio, 1500 Summit St., Austin, TX 78741 (512) 443-4567
Pro Audio Systems, 11057 - 8th Ave N E., Seattle, WA 98125 (206) 367-6800
Studiotech Corp., 7033 Trans-Canada Hwy., Suite 208, St Laurent Que Canada H4T 1S2 (514) 336-5142
Tele-Tech Electronics Ltd., 920 Dennison St., Unit 11, Markham Ont., Canada L3R 1C1 (416) 495-5646
Commercial Electronics Ltd., 1335 Burrard St., Vancouver BC Canada V6Z 1Z7 (604) 669-5525

MCI/Quantel, Box 50810, Palo Alto, CA 94303

MCL Inc., 10 N. Beach, LaGrange, IL 60525

MPB Technologies Inc., P.O. Box 160, Ste-Anne-de-Bellevue, Que., Canada H9X 3L5

Magnasync/Moviola Corp., 5539 Riverton Ave., No. Hollywood, CA 91603

Magna-Tech Electronic Co., Inc., 630 Ninth Ave., New York, N.Y. 10036

R Eberenz (212) 586-7240

Magnavox CATV Systems, Inc., 100 Fairgrounds Dr., Manlius, NY 13104

Magnecraft Electric Co., 5575 N. Lynch Ave., Chicago, Ill. 60630

Magnefax Int'l., Inc., Route 1 Box 764, Rogers, AK 72756

Magnum Towers, Inc., 9370 Elder Creek Rd., Sacramento, CA 95826

Mallory Distributor Prod. Co., Mallory Components Group, Box 1284, Indianapolis, IN 46206

The Management, Box 'T', Aledo, TX 76008

Marathon Products Corp., 334 W. Boylston St., West Boylston, MA 01583

Bart Bagdasarian (617) 853-0988

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Northeast Broadcast Lab. Inc., 15 Charles St., So Glens Falls, NY 12801 (518) 793-2181 Wm Bingham
Caveco, 1121 Bellany Rd N., Scarborough, Ont., Canada M1H 3B9 (416) 438-6230 James Smith

Maric Industries Ltd., 2978 Pasture Crescent, Port Coquitlam, BC, Canada V3C 2C2

Marconi Communication Systems Ltd., Maroni House, New Street, Chelmsford, England CM1 1PL

Marconi Electronics Inc., Broadcast & Communication Div., 100 Stonehurst Ct., Northvale, N. J. 07647

Marconi Instruments, Div. of Marconi Electronics Inc., 100 Stonehurst Ct., Northvale, N. J. 07647

Marshall Electronics, Box 2027, Culver City, CA 90230

Marti Electronics, Box 661, Cleburne, TX 76031

George W Marti (817) 645-9163

Matrix Information Systems, Inc., Box 8099, Dallas, TX 75205

Matthews Studio Equipment, Inc., 2405 Empire Ave., Burbank, CA 91504

Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730

Maxell Corp. of America, 60 Oxford Dr., Moonachie, N. J. 07074

McCurdy Radio Ind. Inc., 1711 Carmen Dr, Elk Grove Village, IL 60007

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McCurdy Radio Industries Ltd., 108 Carnforth Rd., Toronto Ont., Canada M4A 2L4 (416) 751-6262 Jon Young

McInnis, Skinner & Associates, 6529 Classen Blvd., Oklahoma City, OK 73116

McKay Dymek, Inc., Box 5000, Claremont, CA 91711

McMartin Industries, Inc., 4500 South 76th St., Omaha, NE 68127

Mead Data Central, 200 Park Ave., 43rd Floor, New York, NY 10166

Kenneth R. Meades, Box 3831, Beverly Hills, CA 90212

Media Concepts, Inc., 559 49th St. S., St. Petersburg, FL 33707

Memorex Corp., Professional Products Group, 1200 Memorex Drive, Santa Clara, CA 95052

Merlin Engineering Works, Inc., 1880 Embarcadero, Palo Alto, CA 94303

MICMIX Audio Products, Inc., 2995 Ladybird Lane, Dallas, TX 75220

Micro Communications, Inc., Box 4365, Grenier Field, Manchester, N.H. 03108

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Microprobe Electronics, Inc., 875 N. Michigan Ave., Suite 1532A, Chicago, IL 60611

Microtime, Inc., 1280 Blue Hills Ave., Bloomfield, CT 06002

Microtran Co., Inc., Box 236, Valley Stream, N.Y. 11582

Microwave Assoc. Communications, 63 Third Ave., Burlington, MA 01803

Microwave Filter Co., Inc., 6743 Kinne St., East Syracuse, NY 13057

Midas Audio Systems, 54-56 Stanhope St., London, England NW1 3EX

Midwest Corp., Communications Systems Div., 1395 Air Rail Ave., Virginia Beach, VA 23455

Midwest Corp., Mobile Unit Group, One Sperti Dr., Edgewood, KY 41017

Jay Adrick (800) 543-1584

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Midwest Corp., 4720 B-Boston Way, Lanham, MD 20801 (301) 577-4903 John Handley
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Midwest Corp., 7500 Wall St., Cleveland, OH 44125 (216) 447-9745 Brad Nogar
Midwest Corp., 4410 Westerville Rd., Columbus, OH 43229 (614) 476-2800 Fred Higbie
Midwest Corp., A7-156 Space Park S., Antioch Pike, Nashville, TN 37211 (615) 331-5791 John Loughmiller
Midwest Corp., 1395 Air Rail Ave., Virginia Beach, VA 23455 (804) 464-6256 Fred Wood
Midwest Corp., 300 First Ave., Nitro, WV 25143 (304) 722-2921 David Foglesong

Miles Associates, Div. Miles Products Ltd., 240 Birmingham St., Toronto, Ont., Canada M8V 2C8

Millen Components, Elec. Instrument & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180

Miller Professional Equipment, Inc., 10816 Burbank Blvd., North Hollywood, CA 91601

Mineroff Electronics, Inc., Uher Products, 946 Downing Rd., Valley Stream, NY 11580

Minneapolis Magnetics, Inc., 7178 Shady Oak Rd., Eden Prairie, MN 55344

Misar Industries, 17192 Gillette Ave., Irvine, CA 92714

Mitchell Camera Corp., 11630 Tuxford St., Sun Valley, CA 91352

Mitsubishi Elec. America, 2200 W. Artesia Blvd., Compton, CA 90220

Modular Audio Products, Unit of Modular Devices, Inc., 50 Orville Dr., Bohemia, N. Y. 11716

Julius Brick (516) 567-9620

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H. M. Holzberg Assoc. Inc., 115 Sandra Dr., Totowa, NJ 07512 (201) 256-0455 Herbert Holzberg

Modular Sound Systems Inc., DBA-Bag End, Box 488, Barrington, IL 60010

Modulation Associates Inc., 897 Independence Ave., Mountain View, CA 94043

Modulation Sciences, Inc., 99 Myrtle Ave., Brooklyn, NY 11201

Mole-Richardson Co., 937 N. Sycamore Ave., Hollywood, CA 90038

Keith Monks Audio (USA) Inc., 652 Glenbrook Rd., Glenbrook, CT 06906

Monroe Electronics, Inc., 212 Housel Ave., Lyndonville, N.Y. 14098

R. K. Morrison Co., 819 Coventry Rd., Kensington, CA 94707

Moseley Associates, Inc., 111 Castilian Dr., Goleta, CA 93117

Charles F. Rockhill (805) 968-9621

Motorola Communications, and Electronics Inc., 1301 E. Algonquin Rd., Schaumburg, IL 60196

Motorola Semiconductor Products Inc., Box 20912, Phoenix, AZ 85036

Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910

Multiplier Industries Corp., Box 29, Mt. Vernon, NY 10550

Multi-Track Magnetics, Inc., #3 Industrial Ave., Upper Saddle River, NJ 07458

Multronics, Inc., 80 E. Montauk Hwy., Lindenhurst, NY 11757

The Music Director Programming Service, Box 103, Indian Orchard, MA 01151

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N-Pro Co., 1022 Hazelwood Dr., Oregon City, OR 97045

NEC America, Inc., Broadcast Equip. Div., 130 Martin Lane, Elk Grove Village, IL 60007

N.O.V.A. Corp., 5801 Uplander Way, Culver City, CA 90230

Nady Systems Inc., 1145 65th St., Oakland, CA 94608

Nagra Magnetic Recorders, Inc., 19 W. 44th St., Room 715, New York, N.Y. 10036

The Narda Microwave Corp., 435 Moreland Rd., Hauppauge, NY 11758

National Video Services, Commerce Park, Finance Dr., Danbury, CT 06810

Nautel Maine, Inc., RR #1 Tantallon, Halifax County, NS, Canada B0J 3J0

Neal Ferrograph U.S.A., Inc., 652 Glenbrook Rd., Stamford, CT 06906

L. E. Nelson Corp., 1209 Park Circle, Las Vegas, NV 89102

Network Production Music Library, 4429 Morena Blvd., San Diego, CA 92117

Neumade Industries, Inc., 720 White Plains Rd., Scarsdale, N.Y. 10583

Neutrik Products, 77 Selleck St., Stamford, CT 06902

Rupert Neve, Inc., Berkshire Industrial Park, Bethel, CT 06801

Nidus Broadcast Systems, 4090 Youngfield St., Wheat Ridge, CO 80033

North American Soar Corp., 1126 Cornell Ave., Cherry Hill, NJ 08002

North Hills Electronics, Inc., Alexander Pl., Glen Cove, N.Y. 11542

North Wind Power Co., Inc., Box 556, Moretown, VT 05660

Nortronics Co., Inc., Recorder Care Div., 8101 Tenth Ave. N., Minneapolis, MN 55427

Fred A. Nudd Corp., Box 475, 1743 Rt. 104, Ontario, N. Y. 14519

Rick Nudd, V.P. (315) 524-2531

Nurad, Inc., 2165 Druid Park Dr., Baltimore, MD 21211

O

Oak Communications Inc., 16935 W. Bernardo Dr., Rancho Bernardo, CA 92127

Ocean Realm Video, Div. of Ocean Realm Corp., 2333 Brickell Ave., Miami, FL 33129

O'Connor Eng. Labs. Inc., 100 Kalmus Drive, Costa Mesa, CA 92626

Oktel Corp., 490 Division St., Campbell, CA 95008

Old Dominion Broadcast Eng. Service, 1101 Front St., Richmond, VA 23222

Olesen, 1535 Ivar Ave., Hollywood, CA 90028

Omni Q Inc., #8 - 12th St., Blaine, WA 98230

Omnimount Systems, Box 2789, Los Angeles, CA 90068

One Pass Film & Video, One China Basin Bldg., San Francisco, CA 94107

Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, CA 90038

Optical Radiation Corp., 1300 Optical Dr., Azusa, CA 91702

Orban Assoc. Inc., 645 Bryant St., San Francisco, CA 94107

Jesse Maxenchs-Broadcast: Sid Goldstein-Pro/Audio Contact home office for dealers in your area. (415) 957-1067

J. Osawa Ltd., 2-8 Shibaura 4-Chome, Tokyo 108, Japan

Allen Osborne Associates, 5195 N. Douglas Fir Rd., Calabasas, CA 91302

Lois OSborne, Sales Mgr (213) 888-2772

Osram Sales Corp., Box 7062, Newburgh, NY 12550

Otari Corp., 2 Davis Dr., Belmont, CA 94002

Michael Bernard (415) 592-8311

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L P Marketing, 2036 Livingston St., Suite 5, Oakland, CA 94606 (415) 532-5600 Larry Peterson

New West Marketing, 5015 Dumont Place, Woodland Hills, CA 91364 (213) 347-9260 Tom Carlilie

Audities/2001 Enterprises, 2377 E. Mississippi Ave., Denver, CO 80210 (303) 777-4595 Michael Cluphf

J B. Anthony, 992 High Ridge Rd., Stamford, CT 06905 (212) 585-2027 Mike Oltz

Crescendo Associates, 125 Simpson St. N.W., Altanta, GA 30313 (404) 223-0108 Randy Fuchs

Audio Resources, 825 N. Cass Ave., Suite 206, Westmont, IL 60559 (312) 655-1180 Jim Starin

Associated Sales, 8969 B Yellow Brick Rd., Baltimore, MD 21237 (301) 574-0550 Phil Walter

GMI, 181 Worchester Rd., Rt. 9, Natick, MA 01760 (617) 237-6544 George Markunas

CM Sales, 2221 Lakeshire, West Bloomfield, MI 48033 (313) 626-2397 Casey McWilliams

Centuriam Marketing, 124 Manchester Rd., P.O Box 1011, Ballwin, MO 63011 (314) 227-7222 Ron Throckmorton

Upstate Marketing, 542 Swaggertown Rd., Glenville, NY 12302 (518) 399-6311 Frank Iaconis

J. B. Parent, 4701 Olentangy River Rd., Columbus, OH 43214 (614) 459-5947 John Essig

Tenicki & Associates, 5719 Kirby, Suite 3, Houston, TX 77005 (713) 528-2005 Randy Tenicki

Northshore Marketing, 1800 N.E. 75th St., Seattle, WA 98115 (206) 524-8672 Lew Barrett

P

Pace, Inc., 9893 Brewers Court, Laurel, MD 20707

Pace Int'l. Corp., 3727 S. Robertson Blvd., Culver City, CA 90230

Pacific Recorders & Eng. Corp., 11100 Roselle St., San Diego, CA 92121

Packaged Lighting Systems, Box 285 - Grant St., Walden, N.Y. 12586

Paladin Corp., 31332 Via Colinas #106, Westlake Village, CA 91361

Panasonic Company, One Panasonic Way, Secaucus, N.J. 07094

Authur G Cohen, Product Coordinator (201) 348-7170

Panasonic Co., Professional Audio Div., One Panasonic Way, Secaucus, NJ 07094

Panasonic Industrial Co., Video Systems Div., One Panasonic Way, Secaucus, N.J. 07094

Parsons Mfg. Corp., 1055 O'Brien Dr., Menlo Park, CA 94025

Penny & Giles, 1640 Fifth St., Suite 224, Santa Monica, CA, 90401

G. Coles (213) 393-0014

Perma Power Electronics, Inc., 5615 Howard Ave., Chicago, IL 60648

Perrott Eng. Labs, Inc., 7201 Lee Hwy., Falls Church, VA 22046

Peters Productions, Inc., 9590 Chesapeake Dr., San Diego, CA 92123

Petersen Mfg. Co., Inc., Box 337, DeWitt, NE 68341

Phase Audio, Inc., 151 N. Angelus, Memphis, TN 38104

Phasecom Corp., 6365 Arizona Circle, Los Angeles, CA 90045

Phelps Dodge Communications Co., Rt. 79, Marlboro, N.J. 07746

Philadelphia Resins Corp., Box 454, Montgomeryville, PA 18936

Gregory Bowen (215) 855-8450

Philips Broadcast Group, Central Dynamics Corp., See also American Data Corp. & Central Dynamics, Box 618, Mahwah, N. J. 07430

Philips Test & Measuring, Instruments, Inc., 85 McKee Dr., Mahwah, N. J. 07430

Robert A. Hynes; Fred Seitz (201) 529-3800, (201) 529-1716

REGIONAL SALES CONTACTS:

Philips Test & Measuring Instruments, Inc., 489 Valley Way, Milpitas, CA 95035 (408) 946-6722 Ted Anderson; John Stanley

Photo Research, Div. of Kollmorgen Corp., 3000 N. Hollywood Way, Burbank, CA 91505

Piclear, Inc., 180 E. Prospect Ave., Mamaroneck, NY 10543

Pinzone Communications Products Inc., 10142 Fairmount Rd., Newbury, Ohio 44065

B. Pinzone Jr., President (304) 296-4493

Pioneer Marketing Corp., 99 E. Magnolia Blvd., Burbank, CA 91502

Plastic Reel Corp. of America, 475 Boulevard, Elmwood Park, NJ 07075

Polarad Electronics, Inc., 5 Delaware Dr., Lake Success, NY 11042

PoleStar Products, Box 18, Belmont, MA 02178

Polyline Corp., 1233 Rand Rd., Des Plaines, IL 60016

John Kaiser, President (312) 298-5300

Porta-Pattern Telecommunications Industries Ltd., 6822 Santa Monica Blvd., Los Angeles, CA 90038

Portable Energy Products, Inc., 1875 S. Pearl St., Denver, CO 80210

Portac Inc., 108 Aero Camino, Goleta, CA 93117

Potomac Instruments, Inc., 932 Philadelphia Ave., Silver Spring, MD 20910

David G Harry, V P (301) 589-2662

Power-Optics, Inc., 341 Main St., Collegeville, PA 19426

Power Products, 2801 Gateway Dr., Pompano Beach, FL 33060

Practical Technology, Box 449, Carmel Valley, CA 93924

Precision Echo, 485 E. Middlefield Rd., Mountain View, CA 94043

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Procart, 7012 27th St. West, Tacoma, WA 98466

Processing Plus, Inc., 59 Brookside Rd., Suite 110, Wescosville, PA 18106

Prodelin Inc., Box 131, Hightstown, N.J. 08520

Professional Audio Services, 3837 East Loop 820 So., Ft. Worth, TX 76119

Project Packaging Inc., CATV Div., Box 11, Manasquan, NJ 08736

ProTech Audio Corp., Flowerfield, Bldg. #1, St. James, NY 11780

Publison Audio Professional, 5-11 Rue Crespin-du-Gast, Paris, France 75011

Pyramid Loudspeaker Corp., 131-15 Fowler Ave., Flushing, NY 11355

Q

QEI Corp., Rt. 73, Kresson, N. J. 08053

QSC Audio Products Inc., 1926 Placentia Ave., Costa Mesa, CA 92627

QSI Systems Inc., 12 Linscott Rd., Woburn, MA 01888

Q-TV, 33 West 60th St., New York, N.Y. 10023

Quad-Eight Electronics, 11929 Vose St., No. Hollywood, CA 91605

Quam-Nichols Co., 234 E. Marquette Rd., Chicago, IL 60637

Quanta Corp., 2440 S. Progress Dr., Salt Lake City, UT 84119

Gary Montgomery (801) 974-0992

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Ouanta International, 16006 Waterloo Rd., Cleveland, OH 44110 Eastern Regional Sales Mgr. (216) 692-3410 Leonard Zaller

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Quantum Audio Labs, Inc., 1905 Riverside Dr., Glendale, CA 91201

Andrew C. Thompson (213) 841-0970

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G E.S.I., 1440 San Pablo Ave., Berkeley, CA 94702 (415) 527-7700 Dick Lindheim

Trankle & Associates, 3782 E. Austin Way, Fresno, CA 93726 (209) 288-0652 Bob Martin

Trankle & Associates, 820 Black Mtn. Rd., Hillsborough, CA 94010 (415) 344-1133 Brian Trankle

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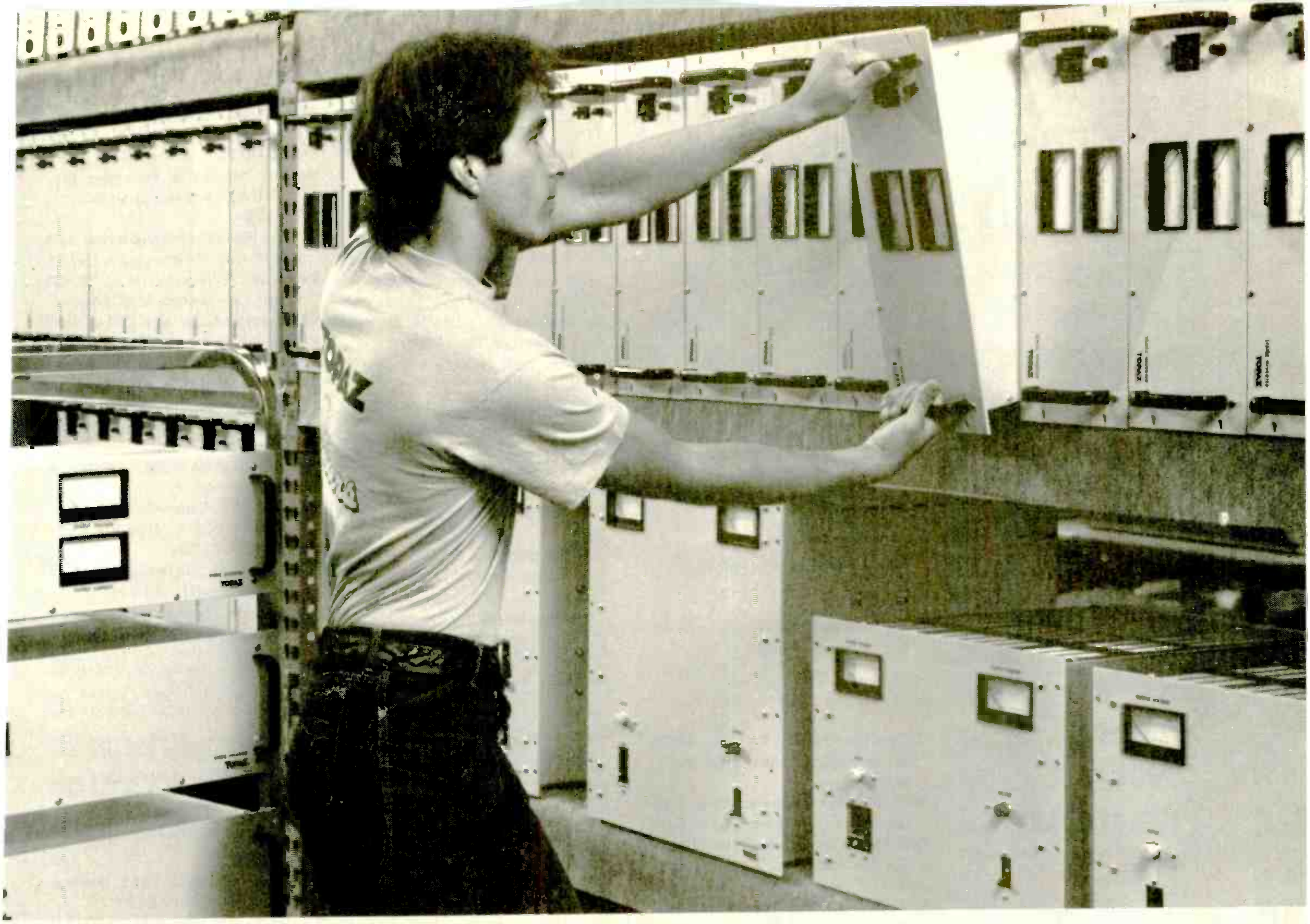

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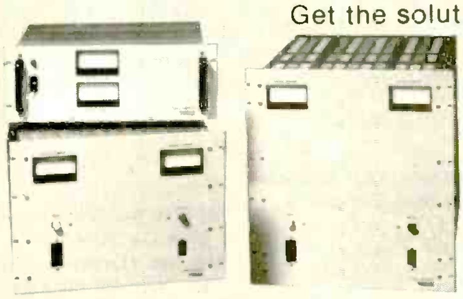

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Milam Audio Corp., 1504 North 8th, Pekin, IL 61554 (309) 346-3161 Jerry Milam
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Associated Sales Reps. Inc., 1274 Estate Drive, West Chester, PA 19380 (215) 436-9272 Rich Wright
Dimension 5 Sound Co., 24 N. Third Street, Womelsdorf, PA 19567 (215) 589-4057 Charley Moore
Technical Systems Reps, Inc., 120 Cambridhe Drive, Clemson, SC 29631 (803) 654-2321 Jim Brawley
Zehritronics, Mapleton Drive at Greentree Rd., Greenville, SC 29607 (803) 288-2641 Dave Zehr
Broadcast Distributors, Bible Place, Cleveland, TN 37311 (615) 472-8200 Tom Duncan
Midcom, Inc., 2231 E. Division Street, Arlington, TX 76011 (817) 461-2211 Mike Simpson
Southwest Pro Audio, 1500 Summit Street, Austin, TX 78741 (512) 443-4567 Greg Klinginsmith
Ludwig Sound, 1022 Hodgkins Street, Houston, TX 77032 (713) 449-8388 Charles Ludwig
Abadon/Sun, Inc., 10330 Kotzebue, San Antonie, TX 78217 (512) 824-8781 Galen Carrol
Rep-Tech, Inc., Rt. 4 Box 197, Terrell, TX 75160 (214) 222-2131 Bobb Partridge
Electro Media, 2555 South 1935 West, Salt Lake City, UT 84119 (801) 973-4206 Kjell Anderson
Alpha Audio, 2049 W Broad Street, Richmond, VA 23220 (804) 358-3852 Nick Colleran
Gemini Electronics Mktg. Co., 1110 N. 17th, Seattle, WA 98133 (206) 542-1116 Dean Nordquist
Broadcast Supply West, 7012 27th St. W., Tacoma, WA 98466 (206) 565-2301 Irving Law

Quick-Set Inc., 3650 Woodhead Drive, Northbrook, IL 60062

R

R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, IL 60035
RCA American Communications, 400 College Rd. E., Princeton, NJ 08540
RCA Broadcast Systems, Front & Cooper Sts. Bldg. 2-2, Camden, N.J. 08102
RCA Distributor & Special Products Div., 2000 Clements Bridge Rd., Deptford, N.J. 08096
RCA Electro Optics and Devices, New Holland Ave., Lancaster, PA 17604

H L Crayton, V.P., Sales (609) 853-2209

REGIONAL SALES CONTACTS:

Applications Eng/Marketing, RCA Electro Optics & Devices, New Holland Ave., Lancaster, PA 17604 (717) 397-7661
Eastern Region Sales, RCA Distributor & Special Products Div., 2000 Clements Bridge Rd., Deptford, NJ 08096 (609) 541-3636
Western Region Sales, RCA Distributor & Special Products Div., 6363 Sunset Blvd., Hollywood, CA 90028 (213) 468-4092

Re: DB Co., A Div. of Pierce Industries Inc., 3120 E. Pico, Los Angeles, CA 90023
R.F. Technology, Inc., 145 Woodward Ave., So. Norwalk, CT 06854
RHG Electronics Laboratory, Inc., 161 E. Industry Court, Deer Park, NY 11729
RKO Tape Corp., 3 Fairfield Crescent, W. Caldwell, NJ 07006
ROH Corp., 3603 Clearview Pl., N.E., Atlanta, GA 30340
RTS Systems, Inc., 1100 W. Chestnut St., Burbank, CA 91506

Robert Tourkow (213) 843-7022

Racal-Decca Canada Inc., Insulators Div., 71 Selby Road, Brampton Ont., Canada L6W 1K5

Patrick Warr (416) 457-8720

Jules Racine & Co., Inc., 85 Executive Blvd., Elmsford, NY 10523

Rack Techniques Corp., Box 473, Batavia, IL 60510
Radiation Systems, Inc., 1501 Moran Rd., Sterling, VA 22170
Radio Programming/Management, 25140 Lahser #232, Southfield, MI 48034
Radio-Research Instrument Co., Inc., 2 Lake Ave. Extension, Danbury, CT 06810
Radio Systems Inc., 5131 W. Chester Pike, Edgemont, PA 19028
RadioCom, 335 East 70th St., New York, NY 10021
Radiotechniques, 402 Tenth Ave., Haddon Hgts., NJ 08035
Radmar, Inc., 1282 Old Skokie Rd., Highland Park, IL 60035
Raindirk Ltd., 33A Bridge St., Downham Market, Norfolk, England PE38 9DW
Ramko Research Inc., 11355 'A' Folsom Blvd., Rancho Cordova, CA 95670

REGIONAL SALES CONTACTS:

Pacific Coast Mktg., 20 S. Santa Cruz Ave., Suite 309, Los Gatos CA 95303 (408) 395-7021 Larry Maguire
Electrex Co., 18680 N.E. 2nd Ave., Miami, FL 33179 (305) 651-5752 Ben Ostrovsky
Repelect, 8406 North Blvd., Tampa, FL 33604 (813) 227-5051 John Govreau
Jim Walters Co., 5017 Kalanianaole Hwy., Honolulu, HI 96821 (808) 373-2701 Jim Walters
Hall Electronics, Box 5031, Boise, ID 83705 (208) 376-1663 Larry Hall
Wiltronix, Inc., 16850 Oakmont Ave., Washington Grove, MD 20880 (301) 258-7676 Dwight Wilcox
Shea Sales, 1612 Worcester Rd. 625A, Framingham, MA 01701 (617) 875-4199 David Hartmann
Shea Sales, 552 Prospect St., Maplewood, NJ 07040 (201) 762-2382 Tom Shea
Doug Cook & Associates, 6300 Carmel Rd., Charlotte, NC 28211 (704) 542-6510 Doug Cook
Southern Coastal Marketing Svc., Inc., 6300 Carmel Rd., Charlotte, NC 28211 (704) 542-6543 Bob Cauthen
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J. N. S. Electronic Industries, P.O. Box 85, Rosanna Victoria 3804 Australia 439-1430 John Stannard
Caveco Equipment Ltd., 1121 Bellamy Rd. N., Unit 10, Scarborough, Ont Canada M1H 3B9 (416) 438-6230 Jim Smith
Lee Engineering Ltd., Napier House, Walton-on-Thames, Surrey, England KT12 1AP 2998 T A Lee

Rank Cintel, Watton Rd., Ware Herts, England SG12 OAE
Rank Precision Industries Inc., 13340 Saticoy, No. Hollywood, CA 91605
Rank Precision Industries Inc., 260 North Rt. 303, West Nyack, NY 10994
Rank Taylor Hobson Ltd., Box 36, Guthlaxton St., Leicester, England LE2 OSL
Raven Screen Corp., 124 East 124th St., New York, N.Y. 10035
The Real World Tech. Group, Inc., 3176 Pullman St., Suite 106, Costa Mesa, CA 92626

Ray Terrill (714) 957-1061

Recortec, Inc., 475 Ellis St., Mountain View, CA 94043
Redwood Marketing, 820 Redwood Dr., Nashville, TN 37200
Reel-O-Matic Systems, Inc., Box 69, Wrightsville, PA 17368
Rees Associates, Inc., 422 Perimeter Center Dr., S. 245, Oklahoma City, OK, 73122
Reliance Plastics & Packaging Div., 225 Belleville Ave., Bloomfield, NJ 07003
Re-Play Video Cartridge Service, 328 Merritt Ave., Pittsburgh, PA 15227
Research Technology Int'l., 4700 Chase, Lincolnwood, IL 60646
Rex Rheostat & Co., Inc., 149 Babylon Turnpike, Roosevelt, N. Y. 11575
Reynolds/Leteron Co., 6704 Valjean Ave., Van Nuys, CA 91406
Richmond Sound Design, Ltd., 1234 West 6th Ave., Vancouver, B.C., Canada V6H 1A5
Robins Industries Corp., 75 Austin Blvd., Commack, NY 11725
Rockwell Int'l., Commercial Elec. Operations, 1200 N. Alma Rd., Richardson, TX 75081
Rohde & Schwarz Sales Co., 14 Gloria Lane, Fairfield, N.J. 07006

Chris Golson; H J. Levine (201) 575-0750

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Victor Duncan Inc., 661 N. LaSalle St., Chicago, IL 60610 (312) 943-7300 Scott Kieffer
Victor Duncan Inc., 32380 Howard, Madison Hgts., MI 48071 (313) 589-1900 Ginny Hart
Victor Duncan Inc., 2659 Fondren, Dallas, TX 75206 (214) 369-1165 Dick Smith

Roll-A-Reel Co. Inc., 7881 Reading Rd., Cincinnati, OH 45237
C.N. Rood B.V., Box 42, 2280 AA Rijswijk, Holland
Rosco Labs Inc., 36 Bush Ave., Port Chester, NY 10573
Ross Video Ltd., Box 220, 9 Iroquois Plaza, Iroquois, Ont., Canada K0E 1K0

Jim Millard (613) 652-4889

REGIONAL SALES CONTACTS:

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Omego Video Inc., 14326 Isis Ave., Lawndale, CA 90260 (213) 679-9021 Rick Riegler
Didier-Denver Inc., 27972 Meadow Dr., P.O. Box 1599, Evergreen, CO 80439 (303) 674-6000 Herb or Steve Didier
Radford Associates, 3203 Lanier Dr., Atlanta, GA 30319 (404) 237-6097 Lew Radford
Roscor Inc., 6160 West Oakton St., Morton Grove, IL 60053 (312) 539-7700 Paul Roston
Wiltronix Inc., P.O Box 364, Washington Grove, MD 20880 (301) 258-7676 Dwight Wilcox
Lines Video Systems, 219 Jefferson St., Springfield, MO 65806 (417) 862-5533 Bud Lines
Landy Associates, 1890 E. Marlton Pike, Cherry Hill, NJ 08003 (609) 424-4660 Jim Landy
Radford Associates, 1331 Otter Creek Rd., Nashville, TN 37215 (615) 373-0231 Ralph Hucaby
The Gene Sudduth Co., 5675 Roadrunner, Beaumont, TX 77708 (713) 899-1341 Gene Sudduth, Jr
The Gene Sudduth Co., 845 39th S.E., P.O. Box 1116, Paris, TX 75460 (214) 785-5764 Gene Sudduth, Sr
ARVID, P.O. Box 5300, Correa Central 1000, Buenos Aires Argentina Ricardo Perez
Advanced Automation Pty Ltd., 6 Dansie St Green Slopes, Brisbane, Australia 4120 07 397 2611 Keith Campbell
Glentronix Ltd., 160 Duncan Mill Rd., Don Mills, Ont., Canada M3B 1Z5 (416) 444-8497 Tom Pressley
Canamex Electronics, 146 Robert Hicks Dr., Willowdale, Ont., Canada M2R 3R5 (416) 665-4327 Jorge Fernandez

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Seltech Equipment, Rose Industrial Estate, Cores End Rd., Bourne End, Bucks, England SL8 5AT 06 285 29131 John Prigmore
Rank Elec. Asia Ltd., Room 801-804 8th Flr., Houston Centre, Ching Yee Rd., Tsimshatsui East, Kowloon Hong Kong Daniel Chiu
Saetong Corp., C.P.O. Box 3590, Seoul, Korea 100 Jeong Seon Oh

Ruslang Corp., 320 Dewey St., Bridgeport, CT 06605

Russco Electronics Mfg. Inc., 5690 E. Shields, Fresno, CA 93727

Rycom Instruments, 9351 E. 59th St., Raytown, MO 64133

S

SGL Waber Electric, 300 Harvard Ave., Westville, N. J. 08093

SSAC Inc., Box 395, Liverpool, N.Y. 13088

SWR Inc., Box 215, Goffstown, N.H. 03045

Sachtler Corp. of America, 400 Oser Ave., Hauppauge, NY 11788

Eric Falkenberg (516) 231-0033

Sachtler GmbH, Dieselstrasse 16, D-8046 Garching, West Germany

Saki Magnetics, Inc., 8650 Hayden Place, Culver City, CA 90230

Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, Ind. 46268

SatCom Technologies, Inc., An RSi Co., 2912 Pacific Dr., Norcross, GA 30071

Satellite Broadcast Network, Inc., Weathermation, Inc., 190 N. State St., Suite 516, Chicago, IL 60601

Scala Electronic Corp., Box 4580, Medford, OR 97501

Scantex Labs Inc., 1 Westmount Sqr., Suite 1200, Montreal, Que., Canada H3Z 2Z7

The Ken Schaffer Group, Inc., 330 West 42nd St., New York, NY 10036

Schneider Corp. of America, 185 Willis Ave., Mineola, N. Y. 11501

Jos. Schneider Optische Werke, Aktiengesellschaft, Ringstrasse 132, D-6550 Bad Kreuznach, West Germany

Schuessler Case Co., Inc., Box 39066, Chicago, IL 60639

Scientific-Atlanta, Inc., Box 105600, Atlanta, GA 30348

Scientific Radio Systems, Inc., 367 Orchard St., Rochester, N.Y. 14606

Scientific Systems, Inc., 92 Westwood Dr., Toms River, NJ 08753

The Screen Works, Ltd., Wilcox-Lange Inc., 3925 N. Pulaski Rd., Chicago, IL 60641

See Hear Industries, Div. of RJA Inc., 717 E. Artesia Blvd., Carson, CA 90746

Selco Products Co., 7580 Stage Rd., Buena Park, CA 90621

Semiconductor Supermarket, 1042 E. Garvey Ave., West Covina, CA 91790

E. Dimura (213) 967-4611/3846

Sennheiser Electronic Corp., 10 West 37th St., New York, N. Y. 10018

Tony Tudisco (212) 239-0190

Sequential Circuits, Inc., 3051 N. First St., San Jose, CA 95134

Sescom, Inc., 1111 Las Vegas Blvd. N., Las Vegas, NV 89101

Setcom Corp., 1400 Stierlin Rd., Mountain View, CA 94043

Sfena Corp., 2617 Aviation Parkway, Grand Prairie, TX 75051

Shallco, Inc., Box 1089, Smithfield, N.C. 27577

Mike Sutton (919) 934-3135

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Westec/Collins, Box 1197, Los Altos, CA 94022 (415) 957-1357 Tom Collins
Southeast Electronics, 1125 Rosselle St., Jacksonville, FL 32203 (904) 356-3007 H. Clark Overton
Imex Ltd., 540 Frontage Rd., Northfield, IL 60093 (312) 446-8934 Ken Such
Graham Electronics, 133 Pennsylvania St., Indianapolis, IN 46204 (317) 634-8486
S & O Sales, 3744 Tanager Dr. N.E., Cedar Rapids, IA 52402 (310) 393-1845 Joseph Swanson
Technical Sales Associates, 9290 Bond St., Suite 114, Box 14842, Shawnee Mission, KS 66214 (913) 888-3330 Bob Frantz
Holden Engineering Sales Co., 1113 Gypsy Lane W., Towson, MD. 21204 (301) 823-3763 Al Holden
MPS Electronics, Inc., 1410 Providence Hwy., Rm. 406, Norwood, MA 02062 (617) 769-8700 Nick Patsos
Audio Distributors, Inc., 2342 Division Ave. So., Grand Rapids, MI 49507 (616) 452-1596
R-J Inc., 7514 Oliver Ave. S., Minneapolis, MN 55423 (612) 866-3661 Bob Johnson
HLJ Associates, 484 Merrick Rd., Box 593, Lynbrook, NY 11563 (516) 599-2999 Herb Johnson
Dan Hurley Sales, Box 26, Pittsford, NY 14534 (716) 586-6159 Dan Hurley
Peerless Radio Corp., 19 Wilbur St., Lynbrook, NY 11563 (516) 593-2121
Lothar Sanford Corp., 1615 Ninth Ave., Bohemia, NY 11716 (516) 737-0700 Carl Molinari
SAI Electronics, Inc., 564 Smith St., Farmingdale, NY 11735 (516) 293-2710
Allen Nace Co., 804 McGraw Court, Box 68, Englewood, OH 45322 (513) 836-0931 George Zaebst
United Radio, Inc., Summit Rd & Reinhold Dr., Cincinnati, OH 45237 (513) 761-4030 Ed Moore
Freedman-Malta Associates, Box 582, King of Prussia, PA 19406 (215) 337-9211 Victor S. Malta
Philadelphia Electronics, 112 North 12th St., Philadelphia, PA 19107 (215) 568-7400 David C. Shaw
Broadcast Equipment & Supply Co., P.O. Box 3141, Bristol, TN 37620 (615) 878-2531 Clifton Droke
Wholesale Electronics, 2809 Ross Ave., Dallas, TX 75201 (214) 824-3001
Carlyle Technical Sales, 979 Industry Dr., Seattle, WA 98188 (206) 575-6750 Carroll O'Mack
Electronics Industries Inc., 19 E. Irving Ave., Oshkosh, WI 54901 (414) 235-8930
Braydon Electro Ltd., 2925 De Miniac St. Laurent, Montreal, Que., Canada H4S 1L8 (514) 332-5650 Don MacKenzie

Sharepoint Systems Inc., 99 Myrtle St., Brooklyn, NY 11201

Sharp Electronics Corp., Professional Products Div., 10 Sharp Plaza, Box 588, Paramus, N.J. 07652

Shintron Co. Inc., 144 Rogers St., Cambridge, MA 02142

Shively Laboratories, Div. of Howell Labs, Inc., 36 Harrison Rd., Bridgton, ME 04009

Shook Electronic Enterprises, Inc., 4846 Whirlwind, San Antonio, TX 78217

Shure Brothers Inc., 222 Hartrey Ave., Evanston, Ill. 60204

Glenn Schrader, V.P./Sales (312) 866-2200

Siegel Electronics, Box 33421, San Diego, CA 92103

Sigma Electronics, Inc., 1830 State St., East Petersburg, PA 17520

Kent Porter (717) 569-2681

Singer Broadcast Products, Inc., Box 5500, Cherry Hill, NJ 08034

Sintronic Corp., See Singer Broadcast Products,

Skirpan Lighting Systems, Inc., 1100 W. Chestnut St., Burbank, CA 91506

Skotel Corp., 1445 Provencher, Brossard, Que. Canada J4W 1Z3

E. Smalling III, Consulting Engineer, 10307 Bernardin, Dallas, TX 75243

Smith-Victor Corp., 301 N. Colfax St., Griffith, IN 46319

Warren R. Smith Co., 110 E. Point Pleasant Ave., Ocean Gate, NJ 08740

Solid Electronics Labs, 49 Fairfield Rd., Havertown, PA 19083

Solid State Logic, Churchfields, Stonesfield, Oxford, England OX7 2PW

Soll, Inc., 401 East 74th St., New York, NY 10021

H. A. Solutec Ltd., 4360 Iberville St., Montreal, Que., Canada H2H 2L8

Gilles Fortin (514) 524-6893

Solve, Inc., Box 689, Putnam, CT 06260

Sonar Radio Corp., 3000 Stirling Rd., Hollywood, FL 33021

The Sonim Corp., South Washington St., Clinton, KY 42031

Sono-Mag Corp., 1833 W. Hovey Ave., Normal, IL 61761

Sontec Electronics, Audio Dr., Goldbond, VA 24094

Sony Corp. of America, 9 W. 57th St., New York, N.Y. 10019

Phil Stack (212) 371-5800

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Sony Corp. of America, Eastern, 15 Essex Rd., Paramus, NJ 07652 (201) 368-5000 George Sheehan
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Sony Corp. of America, Northwestern, 230 W. Hill Place, Brisbane, CA 94005 (415) 467-4900 Matt Celerski
Sony Corp. of America, North Central, 24301 Indoplex Circle, Farmington Hills, MI 48018 (313) 477-4700 Tom Landgraf
Sony Corp. of America, Southeastern, 2300 Peachford Rd., Atlanta GA 30338 (404) 451-7501 Phil Hart, Regional Mgr.
Sony Corp. of America, Southwestern, 1320 Walnut Hill Lnae, Irving, TX 75062 (214) 659-3600 Bill Harlow, Video
Sony Corp. of America, West, 700 W. Artesia Blvd., Compton, CA 90222 (213) 537-4300 Jim Hanson

Soper Sound Music Library, Soper Sound Media Music, Box 498, Palo Alto, CA 94301

Soremec Eclair USA, Inc., 905 N. Cole Ave., Hollywood, CA 90038

Sorensen Co., A Unit of Raytheon Co., 676 Island Pond Rd., Manchester, NH 03103

Sound Technology, 1400 Dell Ave., Campbell, CA 95008

Soundcraft Inc., 20610 Manhattan Place, Suite 120, Torrance, CA 90501

Sounder Electronics Inc., 21 Madrona St., Mill Valley, CA 94941

Spar Aerospace Ltd., 21025 Trans-Canada Hwy., Ste-Anne-de-Bellevue, Que., Canada H9X 3R2

Soundscriber Magnetic, Recording Co., Inc., 85 Willow St., New Haven, CT 06511

Soundstream Inc., 2505 E. Parleys Way, Salt Lake City, UT 84109

Spectra Computer Systems, 391 Chipeta Way, Salt Lake City, UT 84108

Spectra Sonics, 3750 Airport Rd., Ogden, UT 84403

Gregory Dilley (801) 392-7531

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Onyx Systems, Inc., 2615 N. Orange Ave., Orlando, FL 32804 (305) 628-4243 Philip Hale
J. C. Electronics, 2344 Kam Highway, Honolulu, HI 96819 (808) 841-5526 James K. C. Chang
Lake Systems Corp., 55 Chapel St., Newton, MA 02160 (617) 244-6881 Howard Mullinack
Sound Systems, Inc., 8140 Brentwood Industrial Dr., St. Louis, MO 63144 (314) 645-6030 Bert Schultz
KAVCO, Inc., 3931 Image Dr., Dayton, OH 45414 (513) 898-2003 John Wright
A.T.I. 11 North Hwy 89, Suite B, No. Salt Lake City, UT 84054 (801) 292-0075 James Romney
AULOS, 47 Basnett St., Chermside, Brisbane, Australia 4032 (07) 59-5045 Rodney Jacobsen
Cable Bros., 7915 Argyll Rd., Edmonton, Alta, Canada T6C 4A9 (403) 465-9731 Gary Lines

Spectrum Instruments, Inc., Box 97, Hartsdale, NY 10530

Spectrum Planning Inc., Box 1360, Richardson, TX 75080

Sperry Marine Systems, Sperry Corp., Marcus Ave., Great Neck, NY 11020

Sperry Weather Systems, Box 769, Mobile, AL 36601

Sphere Electronics, 20201A Prairie, Chatsworth, CA 91311

Spin Physics, Inc., 3099 Science Park Rd., San Diego, CA 92121

Spindler & Sauppe, Inc., 13034 Saticoy St., North Hollywood, CA 91605

Stainless, Inc., Third & Montgomery Sts., North Wales, PA 19454

Jess C. Rodriquez, VP. Mktg. (215) 699-4871

Stancil Corp., 921 N. Highland, Hollywood, CA 90038

Standard Communications Corp., Box 92151, Los Angeles, CA 90009

Standard Tape Laboratory, Inc., 26120 Eden Landing Rd. #5, Hayward, CA 94545

Frank Lennert, Pres. (415) 786-3546

Stanton Magnetics Inc., Terminal Drive, Plainview, N.Y. 11803

Pete Bidwell (212) 445-0063

Stantron Div., Wyco Metal Products, 6914 Beck Ave., No. Hollywood, CA 91605

Guy Tessier (213) 875-0800

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CEL, 7114 Windingwalk Dr., Houston, TX 77095 (713) 463-7503 Hernon Franco
Barry Sales, 709 Lingo Dr. #105, Richardson, TX 75082 (214) 234-0255 Jack Krone
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Willagen Electronics Assoc., 6170 Perinault Ave., Montreal, Oue., Canada H4K 1M8 (514) 331-4283 Gene Harnett
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Watson Mfg. Co., Kamal Theatre Bldg., Safdarjang Enclave, New Dehli, India 110029 665401 P. S Wallace
RCM Computers Ltd., Feierberg St. 24, P.O. Box 39844, Tel Aviv Israel (03) 224922 Eddie Weigenfeld
Arven S A., PSJE Adan Mejia 103 of 33, Lima 11 Peru (71) 6229 Charles Van-Hemelryck
Intermedia, 405 Altura St., Santa Mesa, Manila, Phillippines 2806 62-32-20 Felix Zamora
Distributronics Inc., Comercio 56, Playa Ponce, Puerto Rico 00731 (809) 843-3321 Jose Martinez
Gen. Electronics & Instrumentation Corp. PTE Ltd., 1st Floor, Kitchener Rd., Suite 117, Singapore 0820 2587633 W. L Chern

Star Case Mfg. Co. Inc., 15525 South 70th Court, Orland Park, IL 60462

Starex, Inc., Box 248, Kearney, NJ 07032

Station Business Systems, Div. Control Data Corp., 600 W. Putnam Ave., Greenwich, CT 06830

Steenbeck, Inc., 9045 Eton Ave., Suite A, Canoga Park, CA 91304

Stellavox, CH-2068 Hauterive/NE, Switzerland

Stephens Electronics, Inc., 3513 Pacific Ave., Burbank, CA 91505

Storeel Corp., 2050-C Carroll Ave., Atlanta, GA 30341

Straight Wire Audio, Inc., 2523 Wilson Blvd., Arlington, VA 22201

Strand Century, Inc., 18111 S. Santa Fe Ave., Rancho Dominguez, CA 90221

Studer Revox America, 1425 Elm Hill Pike, Nashville, TN 37210

Bruno Hochstrasser (615) 254-5651

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Studer Revox America, Inc., 14046 Burbank Blvd., Van Nuys, CA 91401 (213) 780-4234 William Van Doren
Pro Audio, Ltd., 111 S. Dr., Barrington, IL 60010 (312) 381-4559 Brian Tucker
Studer Revox America, Inc., 155 Avenue of the Americas, New York, NY 10013 (212) 255-4462 Tom Mintner
Studer Revox America, 1425 Elm Hill Pike, Nashville, TN 37210 (615) 254-5651 Joe Bean
Studer Revox America, 910 S. Glasgow, Dallas, TX 75223 (214) 760-8647 Chris Ware
Partridge Electronics, P O. Box 21205, Salt Lake City, UT 84117 (801) 272-3131 Clark Partridge

Studio Film & Tape, Inc., 6670 Santa Monica Blvd., Hollywood, CA 90038

Studio Systems Inc., Box 67, Snowdon, Montreal, Que., Canada H3X 3T3

Studio Technologies, Inc., 6666 N. Lincoln, Lincolnwood, IL 60645

Studiomaster Inc., 1365-C Dynamics St., Anaheim, CA 92806

Jon Dobson; Denny Handa (714) 528-4930

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Progressive Marketing, P.O. Box 1269, Brea, CA 92621 (714) 879-7940 Leonard Dozier
Cara Pacific Sales, P.O. Box 9339, Marina Del Rey, CA 90291 (213) 821-7898 Bill Cara
Blackhawk Marketing, 935 Galloway St., Pacific Palisades, CA 90272 (213) 454-5914 Craig Buzzart
W3 Marketing, 4508 Bibb Blvd., Tucker, GA 30084 (404) 938-3008 Wayne Wyche
Modular Sound Systems, 22 N 49 Pepper Rd., Barrington, IL 60010 (800) 323-4970 Willie Warnock
Audio Files, 9172 South Rd. #E, Palos Hills, IL 60465 (312) 974-4709 James Reid
Taub Sales Inc., 12244 Viers Mill Rd., Wheaton, MD 20960 (301) 942-3100 Morton Taub
V F Sales Inc., 181 Worcester Rd., Natick, MA 01760 (617) 237-6544 Vic Faucon, Geo. Markunas
Throckmorton Sales Co. Inc., 124 Manchester Rd., Ballwin, MO 63011 (314) 227-7222 Ron Throckmorton
Hunter Hills #B-5, Flemington, NJ 08822 (201) 788-5914 John Chez
Darmsteadter Associates, 41 R Oswego Sst., Baldwinsville, NY 13027 (315) 638-1261 Charles Eaton
Bob White Associates, P.O Box 39104, Solon, OH 44139 (216) 248-1317 Bob or Tod White
LRT Marketing-Taub Sales, 1921 Wharton Rd., Jenkintown, PA 19046 (301) 942-3100 Len Richter
Lee Sales Co., P.O. Box 5566, Irving, TX 75062 (214) 363-3831 Jim Lee

The Superior Electric Co., 383 Middle St., Bristol, CT 06010

Surcom Associates, Inc., 305 Wisconsin Ave., Oceanside, CA 92054

August Link, President (714) 722-6162

Swager Tower Corp., Box 656, Fremont, IN 46737

Swintek Enterprises, Inc., 1180 Aster Ave., Bldg. J, Sunnyvale, CA 94086

Switchcraft Inc., 5555 N. Elston Ave., Chicago, Ill. 60630

Sylvania Light/GTE, Lighting Center, Danvers, MA 01923

Symetrix Inc., 109 Bell St., Seattle, WA 98121

Symtec Inc., 15933 W. 8-Mile Rd., Detroit, MI 48235

System Wireless Ltd., 11250-14 Roger Bacon Dr., Reston, VA 22090

T

TDK Electronics Corp., 755 Eastgate Blvd., Garden City, N. Y. 11530

TFT Inc./Formerly Time & Frequency Technology Inc., 3090 Oakmead Village Dr., Santa Clara, CA 95051

Dan Balfe (408) 727-7272

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Marcom, P.O. Box 66507, Scotts Valley, CA 95066 (408) 438-4273 Marty Jackson; Ted Tripp
Marcom, 21243 Ventura Blvd., Suite 145, Woodland Hills, CA 91364 (213) 703-0381 Doug Howland
Didier/Denver, P.O. Box 1599, Evergreen, CO 80439 (303) 674-6000 Steve or Herb Didier
Beattie & Associates, 3317 Barrow Hill Trail, Tallahassee, FL 32308 (904) 893-1382 Bob Beattie
Roscom, Inc., P.O. Box 1208, Roswell (Atlanta), GA 30077 (404) 992-2700 Bob Stewart; Ken Wilson
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Central/South American & Puerto Rico, Electrex Co., 18680 N.E. 2nd Ave., Miami, FL 33179 (305) 651-5752 Ben Ostrovsky

TM Systems, Inc., 25 Allen St., Bridgeport, CT 06604

TRW, LSI Products, Box 2472, La Jolla, CA 92038

TSM-Total Spectrum Mfg. Inc., 20 Virginia Ave., West Nyack, NY 10994

T T E, Inc., 2212-14 S. Barry Ave., Los Angeles, CA 90064

J.F Sodaro (213) 478-8224

Taber Mfg. & Eng. Co., 2081 Edison Ave., San Leandro, CA 94577

Tamron Co., Ltd., 17-11, 7-chome Takinogawa, Kita-ku, Tokyo, Japan 114

Tangent Systems, Inc., 2005 E. University, Phoenix, AZ 85034

William B. Tanner Co. Inc., 2714 Union Ext., Memphis, TN 38112

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Tayburn Electronics, Inc., 6106 Avenida Encinas, Carlsbad, CA 92008

Taylor Consumer Industrial Instruments, Sybron Corp., Consumer Prod. Div. Sybron Corp., Arden, N.C. 28704

TEAC Corp of America, 7733 Telegraph Rd., Montebello, CA 90640

David Oren, Mktg. Mgr. Production Products Group, William Mohrhoff, Tascana Production Products (213) 726-0303

Teccom, 252 Mountain Rd., No. Granby, CT 06060

Tech Laboratories Inc., Bergen & Edsall Blvds., Palisades Park, N.J. 07650

C. Schulz (201) 944-2221

Technics, See also Panasonic Co., One Panasonic Way, Secaucus, NJ 07094

Technology Service Corp., Commercial Operations, 2950 31st St., Santa Monica, CA 90405

Techtran Int'l. Inc., Box 2245, Appleton, WI 54913

Tektronix Inc., Box 1700, Delivery Station 53-077, Beaverton, OR 97075

Art Johnson (503) 642-8929

Telaudio Centre, Box 921, Beverly Hills, CA 90213

Telcom Research, 1163 King Rd., Burlington, Ont., Canada L7R 3X5

Tele-Cine Corp., 400 Crossways Park Dr., Woodbury, NY 11797

Tele-Measurements Inc., 145 Main Ave., Clifton, NJ 07014

Telectro Systems Corp., 96-18 43rd AVe., Corona, NY 11368

Teledac Inc., 1575 Taschereau, Longueuil, Que., Canada J4K 2X8

Teledyne Energy Systems, 110 W. Timonium Rd., Timonium, MD 21093

Telemet Div., A Geotel, Co., 185 Dixon Ave., Amityville, N.Y. 11701

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Television Technology Corp., 5970 West 50th Ave., Arvada, CO 80003

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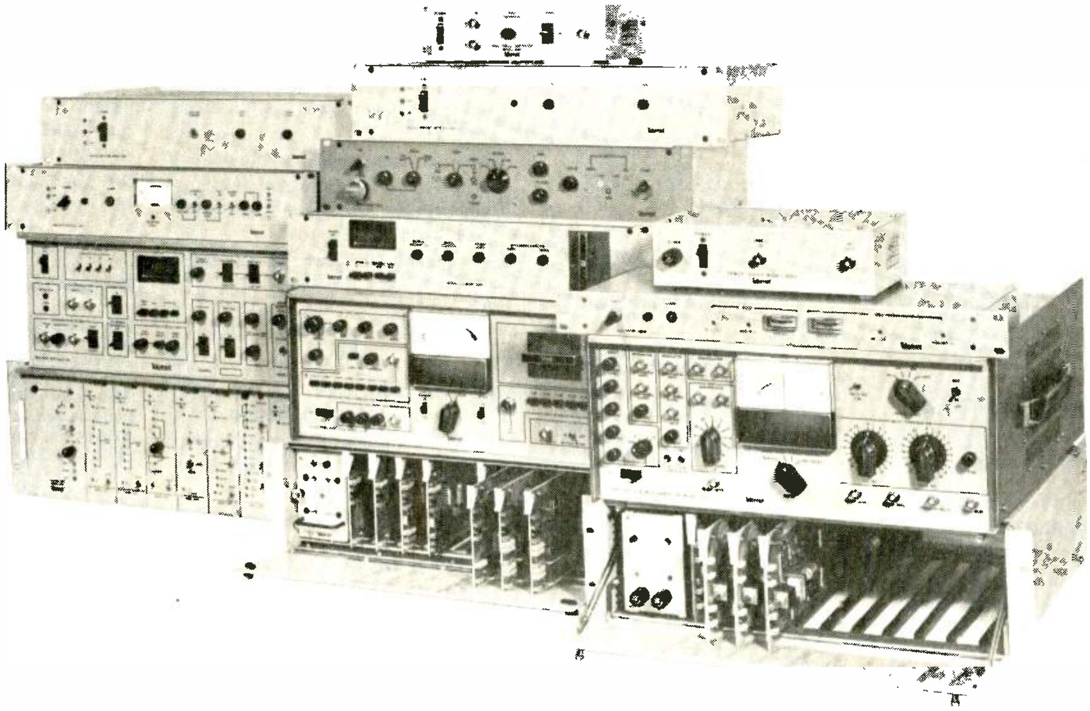

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Envelope Delay Measurement Set, 3705 measures the envelope delay of video frequencies for compliance with FCC requirements.

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Broadcast Demodulator, 4501 accurately demodulates the transmitted signal to show the true video signal being broadcast.

Demod Tester, 4503-A1 quickly checks the broadcast signal demodulator for flatness of frequency response.

Modulator, 4420 is a state of the art cable TV modulator with VSB saw filter, digital display, very low noise and FCC TV transmitter specs.

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Clamper Amplifier, 3203-F clamps high levels of hum on balanced and unbalanced lines. Equalizes for cable loss up to 10 dB.

Fiber Optics Video Transmission System, 4210 has audio subcarrier. Provides interference-free video and aural transmissions for STL and ENG applications.

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Tennaplex Systems Ltd., 34 Bentley Ave., Ottawa, Ont., Canada K2E 6T8

Tentel, 1506 Dell Ave., Campbell, CA 95008

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Tepco Corp., Box 680, Rapid City, S. D. 57709

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3M Co., Magnetic A/V Products Div., 3M Division Center, Bldg. 223-5, St. Paul, MN 55144

360 Systems, 18730 Oxnard St., #215, Tarzana, CA 91356

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Cleveland Enterprises of Colorado, 1602 S. Parker Rd., Suite 102, Denver, CO 80231 (303) 751-3252
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Loren Green Assoc. of Indiana, 4745 West 71st St., Indianapolis, IN 46268 (317) 293-9827
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SESCO, 9432 Common St., Suite B, Baton Rouge, LA 70809 (504) 928-4951
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Power Conversion Systems, 869 Worcester Rd., Rt. 9, Wellesley, MA 02181 (617) 235-7884
O'Hara Associates, 365000 Weideman Dr., Mt. Clemens, MI 48043 (313) 791-7140
Loren Green Assoc. of MN, 6225 University Ave., NE, Minneapolis, MN 55432 (612) 571-6666
ATECH, P.O. Box 396, St. Charles, MO 63301 (319) 363-8573
ATECH, 734 W. Port Plaza, Suite 205, St. Louis, MO 63141 (314) 576-2884
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Ossmann Instruments, 130 Allens Creek Rd., Rochester, NY 14618 (716) 473-5720
Ossmann Instruments, 300 Main St., Vestal, NY 13850 (607) 785-9947
Sun Data Systems, 16 Casa Hermosa N.E., Alburquerque, NM 87112 (505) 292-1022
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Torpey Controls & Eng. Ltd., 2220 Midland Ave. Unit 98, Scarborough, Ont., Canada M1P 3E6

Toshiba Int'l. Corp., Broadcast Electronic Systems, 292 Gibralter Dr., Sunnyvale, CA 94086

Townsend Associates, Inc., 79 Mainline Dr., Westfield, MA 01085

Tracor Inc., Industrial Instruments Div., 6500 Tracor Lane, Bldg. 27-4, Austin, TX 78721

Transist-O-Sound Inc., 728 Yosemite Dr., Indianapolis, IN 46217

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Tri-Tronics Prof. Elec., Inc., Highway 210 N., Box 1067, Lillingron, NC 27546

Trident (USA) Inc., 652 Glenbrook Rd., Stamford, CT 06960

Triple Crown Electronics, Inc., 4560 Fieldgate Dr., Mississauga, Ont., Canada L4W 3W6

Triple S Mfg. Corp., 361 Crosby Ave., Paterson, NJ 07502

Trompeter Electronics, Inc., 8936 Comanche Ave., Chatsworth, CA 91311

True Time Instruments, 3243 Santa Rosa Ave., Santa Rosa, CA 95401

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UHF Associates, 5625 State Farm Dr. #4, Rohnert Park, CA 94928

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UNR-Rohn, UNR, Inc., Box 2000, Peoria, IL 61656

U.S. Instrument Rentals, Inc., 2988 Campus Dr., San Mateo, CA 94403

UTE Microwave, Inc., 3500 Sunset Ave., Asbury Park, NJ 07712

ULTIMATTE Corp., Vlahos-Gottschalk Research Corp., 18607 Topham St., Reseda, CA 91335

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United Recording Electronics Industries, 8460 San Fernando Rd., Sun Valley, CA 91352

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P.R.S., 1616 Soldiers Field Rd., Boston, MA 02135 (617) 254-2110 Peter Engel
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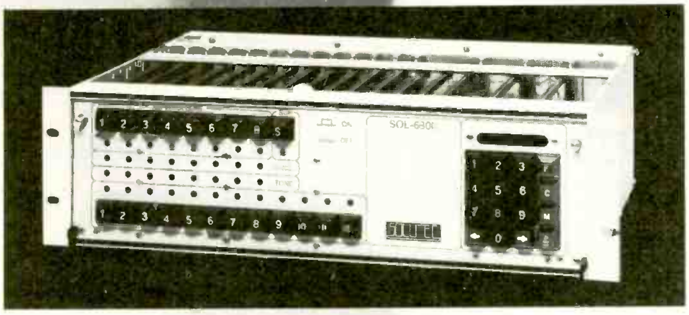

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Video Rentals, Inc., 100 Stonehurst Court, Northvale, NJ 07647

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Vital Industries Inc., 3700 NE 53rd Ave., Gainesville, FL 32601

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W

WIDL Video, 5245 W. Diversey, Chicago, IL 60639

Wallach & Associates Inc., Box 18167, Cleveland, OH 44118

Ward-Beck Systems, Inc., 841 Progress Ave., Scarborough, Ontario, Canada M1H 2X4

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Weather Services Corp., 131 A. Great Rd., Bedford, MA 01730

Western Electronic Products Co., 107 Los Molinos, San Clemente, CA 92672

Western Tele-Communications, Inc., Box 22595, Wellshire Sta., Denver, CO 80222

Western Union, Video Services, One Lake St., Upper Saddle River, NJ 07458

Westinghouse Elec. Corp., Semiconductor Div., Youngwood, PA 15697

Westinghouse Electric Corp., Ind. & Govt't Tube Div., Westinghouse Circle, Horseheads, N.Y. 14845

Westlake Audio, Professional Products Mfg. Group, 2696 Lavery Court, Unit 18, Newbury Park, CA 91320

Westrex Div., Litton Industries, 2629 W. Olive Ave., Burbank, CA 91505

Wide Band Engineering Co., Inc., Box 21652, Phoenix, AZ 85036

Wide Range Electronics, 2119 Schuetz Rd., St. Louis, MO 63141

Wilkinson Electronics, Inc., 5970 West 50th Ave., Arvada, CO 80003

The Will-Burt Co., TMD Div., Box 126, Wooster, OH 44691

Winegard CATV Div., Box 329, Montgomeryville, PA 18936

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G. R. Hoska (612) 888-1957

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Wold Communications, 10880 Wilshire Blvd., Los Angeles, CA 90024

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2912 W. 10 St.,
(2) Kansas City, Mo. 64105
(816-842-1234)
(3) IA, KS, MO, OK, 1, 2, 5, 7, 9

(1) firm name, street address
(2) city, state, zip code, telephone
(3) geographic area served and products handled (see code keys)

This firm covers Iowa, Kansas, Missouri and Oklahoma, and sells audio equipment, video equipment, tape, film equipment, and does service and repair work.

Listings are arranged alphabetically by state. Companies listed do not comprise all dealers/distributors serving an area, but only those that returned BE's listing form.

An example of a typical dealer/distributor listing, the geographic area and product classification code keys, are included on this page to assist you. We think you will find that this section, along with the updated *Product Directory* and *Broadcast Product Manufacturers' Addresses* sections, make this issue the most useful and comprehensive purchasing aid for the broadcast industry.

Key to product numerical code

1 **AUDIO EQUIPMENT** (including recorders, microphones, mixers, consoles, cart machines, turntables, processing devices, etc.)
2 **VIDEO EQUIPMENT** (including cameras, videotape recorders, production switchers, monitors, lights, etc.)
3 **TEST AND MEASUREMENT EQUIPMENT** (audio and video)
4 **TRANSMITTERS, ANTENNAS AND TRANSMISSION SYSTEMS** (including towers, ATS, STL, MDS, etc.)
5 **TAPE** (including video and audio recording tape, etc.)
6 **VACUUM TUBES** (including video camera, transmitter, TWT, etc.)
7 **FILM EQUIPMENT** (including cine cameras, processing equipment, film projectors, etc.)
8 **VANS AND ACCESSORIES**
9 **SERVICE AND REPAIR**
10 **SYSTEM DESIGN** (including studio installation, etc.)
11 **USED EQUIPMENT** (including leasing, rent, etc.)

Key to geographical area code

AK	Alaska	MN	Minnesota	VI	Virgin Islands
AL	Alabama	MO	Missouri	VT	Vermont
AR	Arkansas	MS	Mississippi	WA	Washington
AZ	Arizona	MT	Montana	WI	Wisconsin
CA	California	NC	North Carolina	WV	West Virginia
CO	Colorado	ND	North Dakota	WY	Wyoming
CT	Connecticut	NE	Nebraska		
DC	District of Columbia	NH	New Hampshire		
DE	Delaware	NJ	New Jersey		
FL	Florida	NM	New Mexico		
GA	Georgia	NV	Nevada		
GU	Guam	NY	New York		
HI	Hawaii	OH	Ohio		
IA	Iowa	OK	Oklahoma		
ID	Idaho	OR	Oregon		
IL	Illinois	PA	Pennsylvania		
IN	Indiana	PR	Puerto Rico		
KS	Kansas	RI	Rhode Island		
KY	Kentucky	SC	South Carolina		
LA	Louisiana	SD	South Dakota		
MA	Massachusetts	TN	Tennessee		
MD	Maryland	TX	Texas		
ME	Maine	UT	Utah		
MI	Michigan	VA	Virginia		

(Abbreviations for Canadian provinces)

ALTA	Alberta
BC	British Columbia
MAN	Manitoba
NB	New Brunswick
NF	Newfoundland
NS	Nova Scotia
ONT	Ontario
PEI	Prince Edward Island
QUE	Quebec
SASK	Saskatchewan
YUK	Yukon Territory

(See page 211 for key to listings)

ALABAMA

Bush & Millimaki Services Inc., 902 Bob Wallace Ave., Huntsville, AL 35801 (205-533-9274; 800-633-2080) U.S.A. 2, 3, 7, 9

Consultants, Inc., 2866 Dauphin St., Suite A, Mobile, AL 36616 (205-476-2051) AL, West-FL, MS 2, 5, 8, 9, 10

ALASKA

Alaska Electronics Supply, Inc., 5401 Fairbanks St., Suite 1&2, Anchorage, AK 99502 (907-272-9416) AK 1 3, 5, 6

Harry J. Lang & Associates, 1371 Hillcrest Dr. #303, Anchorage, AK 99503 (907-279-5741) AK 1, 3, 4, 5

NVS Systems, Inc., 8300 King St., Anchorage, AK 99502 (907-279-5571) AK 1, 2, 3, 4, 5, 7, 9, 10

ARIZONA

Spencer Broadcast, Inc., 2338 W. Royal Palm Rd., Suite E, Phoenix, AZ 85021 (602-242-2211) AZ, CA, CO, NV, NM, TX, UT 1, 3, 4, 5, 9, 10, 11

Telesource Communication Services, Inc., 730 E. Highland Ave.; Box 7132, Phoenix, AZ 85011 (602/265-1232) U.S.A. 2

Jensen Tools Inc., 1230 S. Priest Dr., Tempe, AZ 85281 (602-968-6241) U.S.A. 9

See advertisement on page 220

ROH'S Inc., 4553 E. Broadway, Tucson, AZ 85711 (602-795-8573) AZ, NM 1, 2, 5, 9, 10

ARKANSAS

Custom Products, 107 E. Calhoun, Magnolia, AR 71753 (501-234-7399) AR, LA, MS, OK, TN, TX 1, 3

CALIFORNIA

Interface Data Systems, 2990 E. La Jolla St., Anaheim, CA 92806 (714-630-8030) CA, NY 2

Interface Television Systems, 2990 E. LaJolla St., Anaheim, CA 92806 (714-630-8030) AZ, CA, NV, NM, OR, WA 1, 2, 3, 4, 5, 8, 10

Martel Electronics, Inc., 970 E. Orangethorpe #A, Anaheim, CA 92801 (714-871-7102) U.S.A. 1, 9

Christy's Editorial Film Supply Inc., 135 N. Victory Blvd., Burbank, CA 91502 (213-845-1755) Worldwide 7, 9, 11

Pioneer Marketing Corp., 99 E. Magnolia Blvd., Burbank, CA 91502 (213-842-7165) AK, AZ, CA, CO, HI, ID, KS, MT, NE, NV, NM, ND, OK, OR, SD, TX, UT, WA, WY, Canada-Alta, BC, Man. 7

Tritronics, Inc., 2921 W. Alameda Ave., Burbank, CA 91505 (213-843-2170 in CA-800-232-2141; outside CA-800-423-3640) AZ, CA, HI, NV, NM, OR, TX, UT, WA 1, 2, 3, 5, 6, 8, 9, 10, 11

Meyer, Ross & Fleming, Inc., 1485 Rollins Rd., Burlingame, CA 94010 (415-348-6800) CA, HI, NV CA, HI, NV 1, 2, 3, 5

Richard W. Burden Associates, 20944 Sherman Way, Canoga Park, CA 91303 (213-340-4590) AK, AZ, CA, CO, Hi, ID, NV, NY, OR, UT, WA, WY 1, 3, 4, 9, 10

E-N-G Corp., Box 367, Concord, CA 94518 (415-798-4060) Worldwide 2, 4, 8

The Real World Technologies Group, Inc., 3176 Pullman St., Suite 106, Costa Mesa, CA 92626 (714-957-1061) CA 1, 2, 3, 8, 9, 10

Marshall Electronics, Mogami Products Div., Box 2027, Culver City, CA 90230 (213/836-4288) U.S.A. 1, 2

System Associates, 5801 Uplander Way, Culver City, CA 90230 (213-641-2042) #5 & 11-North America; #2-AZ, CA, NV 2, 5, 11

Western Broadcast Systems, 10707 Amulet Place, Cupertino, CA 95014 (408-749-0900) CA, NV, OR, WA 1, 2, 3, 4, 5

SAECO International, 1122 E. Chevy Chase Dr., Glendale, CA 91205 (213-245-7708) Worldwide 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Olesen, 1535 Ivar Ave., Hollywood, CA 90028 (213-461-4631) Worldwide 2, 10

Shoreline, Ltd., 3611 Cahuenga Boulevard West, Hollywood, CA 90068 (213/851-1236) CA 1, 2, 3, 4, 6

Studio Film & Tape Inc., 6670 Santa Monica Blvd., Hollywood, CA 90038 (213-466-8101) U.S.A. and Canada 3, 5

Videotape Products, Inc., 7165 Sunset Blvd., Hollywood, CA 90046 (213-874-7711) Worldwide 5

Broadcast Cartridge Service, 15131 Triton Lane, Suite 108, Huntington Beach, CA 92649 (714-898-7224) U.S.A. 5, 9

A-Vidd Electronics Co., 2210 Bellflower Blvd., Long Beach, CA 90815 (213-598-0444 or 714-821-0870) Southern CA 2, 5

Birns & Sawyer, Inc., 1026 N. Highland Ave., Los Angeles, CA 90038 (213-466-8211) U.S.A., Canada, Int'l. 2, 7, 9, 11

ECD Industries, Inc., 2034 Armacost Ave., Los Angeles, CA 90025 (213/820-3009) U.S.A. and Canada 6

Tech Camera & Tech Camera Video Systems, 6370 Santa Monica Blvd., Los Angeles, CA 90038 (213-446-3238) CA, CO, OR, WA, BC in Canada 1, 2, 5, 7, 9, 11

Westlake Audio, Professional Audio Sales Group, 7265 Santa Monica Blvd., Los Angeles, CA 90046 (213-851-9800) Worldwide 1, 3, 5, 10

Pacific Coast Marketing, 20 S. Santa Cruz Ave., Suite 309, Los Gatos, CA 95030 (408-395-7021) CA, NV 1, 3, 4

Cara Int'l. Ltd., Box 9339, Marina del Rey, CA 90291 (213-821-7898) AZ, CA, NV 1, 3

Lakeside Associates, Inc., 27939 Chiclana, Mission Viejo, CA 92692 (714-855-3171) U.S.A. and Canada 1, 2, 10

A-Vidd Electronics Co., 4930 Campus Dr., Newport Beach, CA 92660 (213-598-0444; 714-821-0870) Southern-CA 2, 5

Broadcast Audio Corp., 11306 Sunco Dr., Rancho Cordova, CA 95670 (916-635-1048 Worldwide 1

Lang Video Systems Corp., 700 Warrington Ave., Redwood City, CA 94063 (415-364-1287) U.S.A. 1, 2, 3, 4, 8, 9, 10, 11

Communications Company, Inc., 3940 Noell St., San Diego, CA 92110 (714-297-3261) CA 1, 3

Network Recording Products, 4429 Morena Blvd., San Diego, CA 92117 (714-272-2011) U.S.A. 1, 5

Sound Genesis, 2001 Bryant St., San Francisco, CA 94110 (415-285-8900) AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA 1, 3, 5, 9, 10, 11

Sound Dynamics, Inc., Box 32055, San Jose, CA 95152 (408-926-3588) (SF 415-668-3588) (OR-503-226-3588) CA, OR, WA 1, 9

David Lint Associates, 3350 Scott Blvd., Bldg. 5, Santa Clara, CA 95051 (408-727-0964) #4 Only-AZ, CA, ID, NV, OR WA; Others-Worldwide 1, 2, 4, 5, 7, 9, 10, 11

Cinecare Int'l., Box 1983, Santa Monica, CA 90406 (213-451-2640) Worldwide 7, 9

MARCOM, Box 66507, Scotts Valley, CA 95066 (408-438-4273) AK, AZ, CA, HI, NV, OR, WA 1, 2, 3, 4, 6, 10, 11

Davis Electronics Co., Box 128, Sierra Madre, CA 91024 (213-355-6909) CA, HI 4, 9, 10

Sound Investment Enterprises, Box 4139, Thousand Oaks, CA 91359 (213-991-3400) AL, AZ, AR, CA, CC, FL, HI, IL, IN, IA, KS, LA, MI, MS, MO, NV, NM, NC, OK, OR, SC, TN, TX, UT, WY 1, 3. 5

Feathercam Inc., 7240 Valjean Ave., Van Nuys, CA 91406 (213-989-5222) CA, CO, FL, NV, TX, BC, Ont. 2, 7

MARCOM, 21243 Ventura Blvd., Suite 145, Woodland Hills, CA 91364 (213-703-0381) AK, AZ, CA, HI, NV, OR, WA 1, 2, 3, 4, 6, 10, 11

COLORADO

Colorado Magnetics, Box 713, Colorado Springs, CO 80901 (303-596-0684) AZ, CA, CO, FL, ID, KS, MO, MT, NE, NV, NM, ND, OH, OK, OR, SD, TX, UT, WA, WY 1, 3, 5

Davis Audio-Visual, Inc., 1801 Federal Blvd., Denver, CO 80204 (303-455-1122) AZ, CO, KS, NE, NM, OK, UT, WY 1, 2, 3, 5, 7, 8, 9, 10, 11

Film/Video Equipment Service Co., 1875 S. Pearl St., Denver, CO 80210 (303-778-8616) AZ, CO, KS, MT, NE, NV, NM, ND, SD, UT, WY 1, 2, 7, 9, 11

Western Tele-Communications, Inc., Box 22595, Wellshire Station, Denver, CO 80222 (303-771-8200) AZ, CA, CO, ID, KS, MT, NE, NV, NM, ND, OR, SD, UT, WA, WY 4, 10, 11

Didier/Denver, Inc., Box 1599, Evergreen, CO 80439 (303-674-6000) CO, ID, KS, MT, NE, NM, UT, WY 1, 2, 3, 4, 10

H P Marketing Co., 2530 W. Church Ave., Littleton, CO 80120 (303-794-8367 or 800-525-8620) AZ, CO, ID, MT, NM, El Paso TX, UT, WY 1, 2, 3

CONNECTICUT

East Coast Sound, 40 Main St., Danbury, CT 06810 (203-748-1614) U.S.A. 1, 10, 11

National Video Services, Commerce Park, Finance Dr., Danbury, CT 06810 (203-792-3862) CT, DC, ME, MA, NH, NJ, NY, PA, RI, VT 2, 5, 9, 10

Audiotechniques Inc., 652 Glenbrook Rd., Stamford, CT 06906 (203-359-2312; Sales: 800-243-2598) CT, DE, DC, ME, MD, MA, NJ, NY, PA, RI, VT, VA 1, 3, 5, 9, 10, 11

Trident (USA) Inc., 652 Glenbrook Rd., Stamford, CT 06906 (203-357-8337) Mid-Atlantic, Mid-West, North East 1

DISTRICT OF COLUMBIA

Comex Corp., Box 17011, Dulles Int'l. Airport, Washington, DC 20041 (703-471-4215) South America 1, 2, 3, 4, 5, 6, 7, 8

FLORIDA

Pro Audio General Store, Inc., 1378 NW 100th Ave., Coral Springs, FL 33065 (305-752-0330) AL, FL, GA, LA, MS, NC, SC 1, 5

Broadcast International, Inc., 1229 N.E. 37th St., Ft. Lauderdale, FL 33334 (305-564-4422) Worldwide 1, 3, 4, 5, 6, 9, 10, 11

Lauderdale Electronic Labs, 16 S.W. 13th St., Ft. Lauderdale, FL 33315 (305-764-7755) Orders only: (800-327-3793) U.S.A. and Canada 1, 3, 5, 6

Southeast Electronics, Inc., 1125 Rosselle St.; Box 41308, Jacksonville, FL 32203 (904-356-3007) AL, FL, GA 1, 2, 3, 4, 5, 6, 9, 10, 11

Electrex Co., 18680 Northeast 2nd Ave., Miami, FL 33179 (305-651-5752) U.S.A. and Latin America 1, 2, 3, 4, 5, 6, 10

Image Devices Int'l. Inc., Box 610606; 1825 N.E. 149th St., Miami, FL 33181 (305-945-1111) AL, AR, FL, GA, KY, LA, MS, NC, OK, PR, SC, TN, VA, ONT, QUE 1, 2, 3, 5, 7, 8, 9, 10, 11

International Wholesalers of Miami, Inc., 17866 Ipco Rd., No. Miami, FL 33162 (800-327-0596) U.S.A., PR 1, 2

See advertisement on page 250

Lita Broadcasting Distributors, 7154 N.W. 72nd Avenue, Miami, FL 33166 (305-887-1223) FL, Central & South America, Caribbean 1, 4, 5, 6

Midwest Telecommunications, 3331 Northwest 82nd Ave., Miami, FL 33122 (305-592-5355) AL, FL, GA 1, 2, 3, 4, 5, 9, 10

Stage Equipment & Lighting, Inc., 12231 N.E. 13th Court; Box 61000F, Miami, FL 33161 (305-891-2010) AL, FL, GA, Caribbean, Central & South America 2, 9, 10, 11

Bencsik Associates, 1627 E. Silver Springs Blvd., Suite F, Ocala, FL 32670 (904-732-9775) FL, PR 1, 2, 3

Gray Communications, 1605 S. Bumby Ave., Orlando, FL 32806 (305-896-7414) FL 2, 5, 8, 9, 10

Comad Inc., Box 10667, Pensacola, FL 32504 (904-434-9782) U.S.A. 2, 4

Hubbard Communications, Inc., 10383 Oak St., N.E., Suite 5, St. Petersburg, FL 33702 (813-577-7759) FL, PR, VI 1, 2, 3, 4, 5, 7, 8, 10

Media Concepts, Inc., 559 49th St. S., St. Petersburg, FL 33707 (813-321-2122) U.S.A. and Int'l. 1, 2, 5, 9, 10

Design Line Inc., 6204 Benjamin Rd., #209, Tampa, FL 33614 (813-884-1461) U.S.A 1, 5, 7, 9, 10, 11

GEORGIA

Crescendo Associates, 125 Simpson St. N.W., Atlanta, GA 30313 (404-223-0108) AL, FL, GA, MS, NC, SC, TN 1, 10

Image Devices Int'l. Inc., 1651 Phoenix Blvd., Box 490250, Atlanta, GA 30349 (404-996-0000) AL, AR, FL, GA, KY, LA, MS, NC, OK, PR, SC, TN, VA, ONT, QUE 1, 2, 3, 5, 7, 8, 9, 10, 11

Siboney Audio Visual Products, Inc., 6649 Peachtree Industrial Blvd., Atlanta/Norcross, GA 30092 (404-441-3300) AL, AR, CA, FL, GA, OK, TN, TX 1, 2, 5, 7, 8, 9, 10, 11

Technical Industries Inc. of Georgia, 6000 Peachtree Rd., N.E., Atlanta, GA 30341 (404-455-7610) GA, SC 1, 2, 3, 4, 9, 10, 11

Quality Media Corp., Box 7008, Columbus, GA 31908 (800-241-7878; in GA 404-324-1271) U.S.A. and Canada 1, 2, 3, 4, 5, 6, 7, 8, 10, 11

Gray Communications, 3684 Clearview Ave., Doraville-(Atlanta), GA 30340 (404-455-3121) AL, GA, NC, SC, TN 1, 2, 5, 7, 8, 9, 10

Dynacom Electronics Ltd., 590 Commerce Park Dr., Suite 125, Marietta, GA 30060 (404-428-3100) U.S.A., Canada, Mexico 4, 10

C. Harrison Associates, Inc., 6290 McDonough Dr., Suite E, Norcross, GA 30093 (404-449-7696) AL, FL, GA, MS, NC, SC, TN 2, 4

Broadcast Communication Associates, Box 2606, Peachtree City, GA 30269 (404-487-9559) U.S.A. and Canada 1, 3, 4, 5, 10, 11

Allied Broadcast Equipment, 4405 Mall Blvd., Suite 314, Union City, GA 30291 (404-964-1464) Worldwide 1, 3, 4, 5, 6, 9, 10

HAWAII

Broadcast Services Inc., 2877 Kalakaua Ave., Honolulu, HI 96815 (808-521-6311) HI 1, 4, 6, 9, 10, 11

Hawaii Broadcast Associates, Box 1344, Honolulu, HI 96807 (808-947-7470) HI 4

Omega Pacific, 570 Auahi St., #204, Honolulu, HI 96813 (808-533-7655) HI 2, 3, 4, 5

IDAHO

Hall Electronics, Box 5031, Boise, ID 83705 (208-336-5894) CO, ID, MT, UT, WY 1, 3, 4, 5, 6, 10, 11

ILLINOIS

Modular Sound Systems Inc., DBA-Bag End, Box 488, Barrington, IL 60010 (312-382-4550) IL 1

AVC Systems, Inc., 7116 W. Higgins Ave., Chicago, IL 60656 (312/763-6010) IL, IN, IA, MI, MN, NE, ND, SD, WI 1, 3, 4, 5, 9, 10, 11

Allied Broadcast Equipment, 5485 N. Lawler Ave., Chicago, IL 60630 (312-784-2257) Worldwide 1, 3, 4, 5, 6, 9, 10

Center Video Center, 5565 N. Elston Ave., Chicago, IL 60630 (312-637-1600; outside IL-800-621-4354) U.S.A. 1, 2, 3, 5, 9, 10, 11

Ottawa Equipment Co., 6838 N. Ottawa Ave., Chicago, IL 60631 (312-774-5115) IL, IN, WI, Export 1, 4, 5, 6, 10

Victor Duncan, Inc., 661 N. LaSalle, Chicago, IL 60610 (312-943-7300) U.S.A. and Canada 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

WIDL Video, 5245 W. Diversey, Chicago, IL 60639 (312-622-9606) Worldwide 1, 3, 5, 8

Richardson Electronics, Ltd., 3030 N. River Rd., Franklin Park, IL 60131 (312-456-0600) U.S.A. 6

Swiderski Electronics, Inc., 1200 Greenleaf Ave., Elk Grove Village, IL 60007 (312-364-1900) IL, IN, IA, MI, MO, WI 1, 2, 3, 5, 6, 7, 8, 9, 10, 11

Columbia Video Systems, The Columbia Bldg., Laurel & 2nd, Highland Park, IL 60035 (312-433-6010) IL, IN, IA, MI, WI 2, 3, 5, 7, 10

See advertisement on page 189

GO Video Sales, Inc., 1195 S. Wilson Dr., Lake Forest, IL 60045 (312-295-6726) North-IL, Northwest-IN, Davenport IA, MN, ND, SD, East-WI 2

Roscor Corp., 6160 Oakton, Morton Grove, IL 60053 (312-966-3010 or 539-7700) IL, IA, KY, MI, OH, WI 1, 2, 3, 5, 8, 9, 10, 11

Joseph Electronics, 8830 Milwaukee Ave., Niles, IL 60648 (312-297-4200) IL, IN, WI, Nat'l. Mail Order 3, 5, 6

Milam Audio, 1504 North 8th St., Pekin, IL 61554 (309-346-3161) CO, IL, IN, IA, KS, MI, MO, OH, OK, TX, WI 1, 5, 9, 10, 11

Broadcast Electronics, Inc., 4100 N. 24th St.; Box 3606, Quincy, IL 62305 (217-224-9600) U.S.A., Canada, PR, VI 1, 3, 5, 6

Harris Corp., Broadcast Div., Box 4290, Quincy, IL 62305 (217-222-8200) U.S.A. and Canada 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Anixter Communications, 4711 Golf Rd., Skokie, IL 60076 (312-677-2600) U.S.A., Canada, AK, HI 4

INDIANA

Infonics, Inc., Box 1111, 238 Hiway 212, Michigan City, IN 46360 (219-879-3381) U.S.A. 1

Allied Broadcast Equipment, #One, 635 South E St., Richmond, IN 47374 (317-962-8596) Worldwide 1, 3, 4, 5, 6, 9, 10

IOWA

Kimian Sales, Inc., Box 503; 1804 Sycamore St., Atlantic, IA 50022 (712-243-1626) IL, IA, KS, MO 1, 2

Triangle Audio Visual, 6336 Hickman Rd., Des Moines, IA 50322 (515-278-2929) IA, MN, NE, ND, SD 1, 2, 3, 5, 6, 7, 9, 10, 11

Sitler's Supplies, Inc., 702 E. Washington, Box 10, Washington, IA 52353 (319-653-2123) U.S.A. 7

Telfax Communications, Box 31, Webster City, IA 50595 (515-832-1263) U.S.A. 1

KANSAS

Business Communications, Inc., 1140 Cambridge Circle Dr., Kansas City, KS 66103 (913-342-4000) AR, IA, KS, MC, NE, OK 1, 2, 5, 9, 10, 11

Steve Smith Audio-Visual, Inc., 623 Kansas Ave.; Box 1216, Topeka, KS 66601 (913-235-3481) KS, Western MO including St. Joseph and K.C. 1, 2, 5, 9, 10, 11

Radio Supply Co., Inc., 131 Laura; Box 1220, Wichita, KS 67201 (316-267-5213) KS, OK 1, 2, 3, 5, 6

Theatrical Services Inc., 128 S. Washington, Wichita, KS 67202 (316-263-4415) AZ, CO, IA, KS, MO, NE, OK 10

KENTUCKY

Midwest Corp., One Sperti Dr., Edgewood, KY 41017 (606-331-8990) U.S.A., GU, PR, VI 1, 2, 3, 4, 5, 6, 8, 9, 10, 11

Bruce L. Dawson & Associates, Central American Terminal-Bowman Field, Louisville, KY 40205 (502-456-6666, 6693) IN, KY, OH 1, 2, 4

LOUISIANA

Gray Communications, 910 N. Bon Marche, Suite 'E', Baton Rouge, LA 70806 (504-924-2298) LA 1, 2, 3, 4, 5, 7, 8, 9, 10, 11

Wm. B. Allen Supply Co., Inc., 1601 Basin St., New Orleans, LA 70116 (504-525-8222; 800-535-9593; LA only 800-462-9520) Nationwide 1, 2, 3, 4, 5, 6

Audiomedia Associates, Box 29264, New Orleans, LA 70189 (504-586-0140) AL, AR, FL, LA, MS, TX 1, 3, 4, 5, 9, 10

See advertisement on page 258

Gray Communications, 5441 Pepsi St., New Orleans, LA 70123 (504-733-7265) AR, LA 1, 2, 3, 4, 5, 7, 8, 9, 10, 11

MARYLAND

Associated Sales Reps, Inc., 8969 B Yellow Brick Rd., Baltimore, MD 21237 (301-574-0550) DE, DC, MD, NJ, PA, VA 1, 2, 3, 5

David H. Brothers Co., Inc., 19 Old Court Rd., Baltimore, MD 21208 (301-764-7189) DC, MD, VA 1, 2, 5, 6

Music Sound Distributors, 6730 Santa Barbara Court, Baltimore, MD 21227 (301-796-3984) U.S.A. and Canada 1, 2, 5

Theatre Service & Supply Corp., 1792 Union Ave., Baltimore, MD 21211 (301-467-1225) U.S.A. 1, 2, 7, 9, 10, 11

Ritz A-V Cine Sound, 11710 Baltimore Blvd., Beltsville, MD 20705 (202-244-3800) DC, MD, OH, PA, VA, WV 1, 2, 5, 7, 9, 10, 11

Professional Products Inc., 4964 Fairmont Ave., Bethesda, MD 20814 (301-657-2141) DC, MD, VA 1, 2, 3, 4, 5, 6, 7, 9, 10, 11

Landy Associates, Inc., 801 Water St., Framingham, MA 01701 (617-443-5708) CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT 1, 2, 3, 5, 7, 10, 11

Midwest Corp., Communications Systems Div., 4720-B Boston Way (Washington D.C.), Lanham, MD 20801 (301-577-4903) North America 1, 2, 4, 5, 8, 9, 10

Peirce-Phelps, Inc., 12288 Wilkins Ave., Rockville, MD 20852 (301-984-7979) U.S.A., GU, PR, VI 1, 2, 3, 5, 8, 9, 10

Wiltronix, Inc., 16850 Oakmont Ave., Washington Grove, MD 20880 (301-258-7676) DE, DC, KY, MD, PA, VA, WV 1, 2, 3, 10

Downlink Systems Inc., 11145 Viers Mill Rd., Wheaton, MD 20902 (301-949-2252) FL, GA, IL, IN, IA, KY, LA, MD, MI, NE, NJ, NY, NC, OH, PA, SC, TN, TX, VT, VI, VA, WV, WI 1, 4, 5, 9, 10, 11

MASSACHUSETTS

Professional Recording & Sound, Inc., 1616 Soldiers Field Rd., Boston, MA 02135 (617-254-2101) CT, ME, MA, NH, RI, VT 1, 3, 5, 9, 10, 11

M. P. Video, Inc., 3 Huron Dr., Natick, MA 01760 (617-965-5405) CT, ME, MA, NH, RI 1, 2, 3, 5, 9, 10, 11

Lake Systems Corp., 55 Chapel St., Newton, MA 02160 (617-244-6881) CT, ME, MA, NH, RI, VT 1, 2, 3, 5, 8, 9, 10, 11

QSI Systems, Inc., 12 Linscott Rd., Woburn, MA 01888 (617-938-1403) U.S.A. 2, 3, 5

MICHIGAN

Thalner Electronic Labs, Inc., 7235 Jackson Rd., Ann Arbor, MI 48103 (313-761-4506 Area 313: ONLY 800-552-5275) MI, OH 1, 2, 3, 4, 5, 6, 8, 9, 10, 11

Sound Solutions Inc., 5701 Canton Center Rd., Canton, MI 48187 (313-453-6586) IL, IN, MI, OH 1, 2, 3, 4, 5, 10

H. M. Dyer Electronics, Inc., 31185 Ten Mile Rd., Farmington Hills, MI 48024 (313-478-2157) IL, IN, IA, MI, MN, MO, OH 1, 2, 3
See advertisement on page 244

Audio Broadcast Group, Inc., 2342 S. Division Ave., Grand Rapids, MI 49507 (616-452-1596) U.S.A. 1, 3, 4, 5, 10, 11

Victor Duncan, Inc., 32380 Howard St., Madison Hgts., MI 48071 U.S.A. and Canada 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

V F Sales Inc., 41940 Joy Rd., Plymouth, MI 48170 (313-453-8720) MI 1, 2, 3

MINNESOTA

Emmons Associates, Inc., 1121 Riverwood Dr., Burnsville, MN 55337 (612-890-8920) IA, MN, ND, SD, WI 1, 2, 4, 9, 11

AVC Systems, Inc., 1517 E. Lake St., Minneapolis, MN 55407 (612-729-8305) IL, IN, IA, MI, MN, NE, ND, SD, WI 1, 3, 4, 5, 9, 10, 11

Todd Communiations Inc., 6545 Cecilia Circle, Minneapolis, MN 55435 (612-941-0556) IA, MN, NE, ND, SD, WI 1, 2, 3, 4, 5, 7, 9, 10, 11
See advertisement on this page

Video Midwest, Inc., 5050 West 78th St., Minneapolis, MN 55435 (612-831-2248) IA, MN 1, 2, 3, 5, 7, 9, 10, 11

Clark R. Gibb Co., 11100 Bren Rd. W., Minnetonka, MN 55343 (612-938-5434) MN, ND, SD, WI 1, 3, 5

T. R. Pitts Co., 501 W. 5th St.; Box 57, Winona, MN 55987 (507-452-2629) All- IL, IN, IA, KY, MD, MI, MN, OH, SD, WI; Parts of - MT 1, 2, 3, 4, 5, 8, 9, 10

MISSISSIPPI

Central School Supply, 310 Airport Rd., Jackson, MS 39208 (601-932-1901) AL, AR, LA, MS, TN 1, 2, 4, 5, 6, 7, 9, 10, 11

Fultec Engineering Services, 4672 Nisqually Rd., Jackson, MS 39206 (601/362-2697) AL, AR, DC, FL, GA, KY, LA, MD, MS, MO, NC, OK, SC, TN, TX, VA, WV 9, 10, 11

MISSOURI

Television Engineering Corp., 580 Goddard Ave., Chesterfield, MO 63017 (314-532-4700) CO, IL, IA, KS, MS, MO, NE, OH, TN 1, 2, 3, 5, 6, 7, 8, 9, 10, 11

Dytec/South Inc., 11657 Adie Rd., Maryland Hts., MO 63043 (314-569-2990) AR, IL, IA, KS, MO, NE, OK 1, 3, 4, 6, 11

Delcom Corp. of St. Louis, 2349 Grissom, St. Louis, MO 63141 (314-432-1164) Continental U.S. 2, 3, 5, 8, 9, 10

MONTANA

Holm-James Distributors Inc., 4th Ave. S. at 6th St., Box 2487, Great Falls, MT 59403 (406/761-2420) MT, Northern-WY 1, 2, 3, 5, 6, 9, 10, 11

NEVADA

Cinema Services, 3050 Sheridan St., Las Vegas, NV 89102 (702-876-4667) AZ, NV, NM, UT 2, 7, 11

NEW HAMPSHIRE

New England Wholesale Supply, dba Video Lab, 250 Derry Rd., Hudson, NH 03051 (603-880-1896) ME, MA, NH, VT 1, 2, 5, 9, 10, 11

Associated Systems, Box 5211, Manchester, NH 03108 (603-472-2297) CT, ME, MA, NH, NY, RI, VT 1, 2, 3

NEW JERSEY

Landy Associates, Inc., 1890 E. Marlton Pike, Cherry Hill, NJ 08003 (609-424-4660) CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT 1, 2, 3, 5, 7, 9, 10, 11

Calvert Electronics Inc., 1 Branca Rd., East Rutherford, NJ 07073 (Out of NJ-800-526-6362; In NJ-201-460-8800) Worldwide 2, 6
See advertisement on page 181

Thor Electronics Corp., 321 Pennsylvania Ave., Linden, NJ 07036 (201-486-3300) Worldwide 6

H. M. HOLZBERG ASSOCIATES, INC.
P.O. Box 322
Totowa, New Jersey 07511

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6545 CECILIA CIRCLE • MINNEAPOLIS, MINNESOTA 55435
PHONE (612) 941-0556

Cinecraft Int'l., Inc. Export Agents, 11 Caesar Place, Moonachie, NJ 07074 (201-939-0875) Worldwide 1, 7, 9, 11

Comprehensive Video Supply Corp., 148 Veterans Dr., Northvale, NJ 07647 (201-767-7990) Worldwide 1, 2, 3, 5, 8

Stylist Systems, Inc., 39 Industrial Ave., Teterboro, NJ 07608 (201/288-6130) USA, Egypt, Nigeria, Saudi Arabia 1, 2, 3, 4, 5, 6, 7, 9, 10

H. M. Holzberg Associates, Inc., Box 322, Totowa, NJ 07511 (201-256-0455) CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT 1, 2, 3, 4, 5, 7, 8, 10

See advertisement on page 214

NEW MEXICO

Magnetic Media Corp., 1213 N. Lea, Roswell, NM 88201 (505-622-6393) Southern NM 1, 2, 3, 5, 9, 10

DYMA Engineering, Inc., Box 1697, Taos, NM 87571 (505-758-8686 or 2686) AZ, CA, CO, KS, NV, NM, OK, TX, UT 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

NEW YORK

Ceco Communications Inc., 2115 Avenue X, Brooklyn, NY 11235 (212-646-6300; 800-221-0860) Worldwide 1, 2, 6

See advertisement on page 153

Microphonics, Box 37, Brooklyn, NY 11204 (212-438-6400) U.S.A. 1

Temtron Electronics Ltd., 15 Main St., East Rockaway, NY 11518 (516-599-6400; 800-645-2300) U.S.A. 5, 6

Sharoubim Int'l. Co., 192-08 90th Ave., Hollis, NY 11423 (212-479-3011) Worldwide 1, 2, 3, 6

Avtech Electronics ,Inc., (fomerly Team Electronics), 24-16 Queens Plaza South, Long Island City, NY 11101 (212-937-9200; 800-221-1300) U.S.A. and Canada 1, 2, 5, 6, 7

Audio-Video Corp., 213 Broadway, Menands (Albany), NY 12204 (518-449-7213) CT, MA, NY, North-PA, VT 1, 2, 3, 5, 9, 10, 11

Boynton Studio Inc., Melody Pines Farm, Morris, NY 13808 (607-263-5695) U.S.A.; in Canada-BC, MAN, NB, NS, ONT, PEI, QUE, SASK 1, 3, 4, 5, 9, 10, 11

Richard W. Burden Associates, 342 Lexington Ave., Mount Kisco, NY 10549 (914-666-3730) U.S.A. 10

Henry Grossman Associates, 519 South 5th Ave., Mount Vernon, NY 10550 (914-664-5393 or 337-4260) CT, DE, DC, FL, ME, MD, MA, NH, NJ, NY, PA, VT, VA 1, 2, 3, 4, 5, 6, 7, 10

Acoustilog, Inc., 19 Mercer St., New York, NY 10013 (212-925-1365) CT, NJ, NY; #10-Worldwide 1, 5, 9, 10, 11

Adcom Communications Inc., 555 West 57th St., New York, NY 10019 (212-265-1760) NY 2, 3, 5, 9, 10, 11

Adwar Video Corp., 100 Fifth Ave., New York, NY 10011 (212-691-0976) Worldwide 1, 2, 3, 5, 6, 9, 10, 11

Audiotechniques Inc., 1619 Broadway, 4th Flr., New York, NY 10019 (212-586-5989; Sales: 800-223-2486) CT, DE, DC, ME, MD, MA, NJ, NY, PA, RI, VT, VA 1, 3, 5, 9, 10, 11

Barbizon Electric Co., Inc., 426 West 55th St., New York, NY 10019 (212-586-1620) AL, CT, DE, DC, FL, GA, IL, IN, KY, ME, MD, MA, MI, MS NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, WI 2

The Camera Mart, Inc., 456 West 55th St., New York, NY 10019 (212-757-6977) CT, ME, MA, MI, NH, NJ, NY, OH, PA, VT 1, 2, 3, 5, 7, 9, 11

Levit Electronics, Inc., 200 Park Ave. S., New York, NY 10003 (212-777-5517; 800-221-2945) Worldwide 6

See advertisement on page 248

MPCS Video Industries, Inc., 514 West 57th St., New York, NY 10019 (212-586-3690) U.S.A. 1, 2, 3, 4, 5, 6, 8, 9, 10, 11

Martin Audio/Video Corp., 423 West 55th St., New York, NY 10019 (212-541-5900) CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, VT 1, 2, 3, 5, 9, 10

RadioCom, 335 East 70th St., New York, NY 10021 (212-794-9702) U.S.A. and Canada 10

The Ken Schaffer Group, Inc., 330 West 42nd St., New York, NY 10036 (212-695-1107) Worldwide 1, 3

Sonocraft Corp., 360 West 31st St., New York, NY 10001 (212-760-9300) NJ, NY 1, 2, 5, 7, 9, 10

Studio Film & Tape Inc., 630 9th Ave., New York, NY 10036 (212-977-9330) U.S.A. and Canada 3, 5

Tape City Int'l. Inc., 404 Park Ave. S., New York, NY 10016 (212-679-1606; 800-223-1586) CT, NJ, NY, Mail Order in U.S.A. 1, 2, 5, 9, 11

United Research Lab Corp., 16 East 52nd St., New York, NY 10022 (212-751-4663) Worldwide 1, 3, 5, 9

Videotape Services Inc., 855 Avenue of the Americas, New York, NY 10001 (212-695-6606) Worldwide 5, 7, 11

R F Gain, Ltd., 100 Merrick Rd., Rockville Centre, NY 11570 (516-536-8868; 800-645-2322) Worldwide 6

Northeast Broadcast Lab., Inc., 15 Charles St.; Box 1176, S. Glens Falls, NY 12801 (518-793-2181) CT, ME, MA, NH, NY, RI, VT 1, 3, 4, 5, 8, 9, 10, 11

Motion Picture Enterprises, Inc., Box 276, Tarrytown, NY 10591 (212-245-0969) Worldwide 2, 5, 7

Singer Products Co., Inc., 875 Merrick Ave., Westbury, NY 11590 (516-333-2000) Worldwide except U.S.A. and Canada 1, 3, 4

Koppe Raden Corp., 34 S. Broadway, White Plains, NY 10601 (914-682-8038) Caribbean, Central America, South America 1, 2, 3, 4, 5, 6, 7, 8

NORTH CAROLINA

Doug Cook & Associates, 6300 Carmel Rd., Charlotte, NC 28211 (800-438-6040; 704-542-6510) AL, FL, GA, KY, OH, W.-PA, TN, WV 1, 2, 3, 4, 10

Southern Coastal Marketing Services, Inc., 6300 Carmel Rd., Charlotte, NC 28211 (704-542-6543) NC, SC, VA 1, 2, 3 4, 5, 9

Electronic Merchandising Enterprises, Inc., 112 Buena Vista, High Point, NC 27260 (919-869-3335) East-KY, NC, SC, East-TN, VA, WV 1, 2, 3, 4

Technical Video Systems, Inc., 215 N. Broad St., Winston-Salem, NC 27101 (919-748-0916) GA, NC, SC, TN, VA, WV 1, 2, 3, 4, 5, 7, 8, 9, 10, 11

NORTH DAKOTA

Audiovisual Inc. Formerly Known As OMF Audiovisual, Inc., 1818 E. Broadway, Bismarck, ND 58501 (701-258-6360) MN, MT, ND, SD 1, 2, 3, 5, 7, 9, 10, 11

OHIO

Cercone Vincent Associates, Inc., 5020 Richmond Rd., Bedford Heights, OH 44146 (216)/292-2550 IN, OH, PA, WV 1, 2, 10, 11

Cartwright Communications Co., 7812 Red Sky Dr., Cincinnati, OH 45242 (513-489-1755; Outside OH-800-543-8614; OH-800-582-2641) U.S.A., AK, HI 3, 4

KAVCO, Inc., 3931 Image Dr., Dayton, OH 45414 (513-898-2003) IN, KY, MI, OH, WV 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

OKLAHOMA

Hill Radio Equipment Co., Route 6, Box 622, Claremore, OK 74017 (918/341-5240) AR, KS, MO, OK 1, 3, 4, 5

Delcom Corp., 1220 Sovereign Row, Oklahoma City, OK 73108 (405-942-1339) Continental U.S. 2, 3, 5, 8, 9, 10

Walter S. Brewer Co., Inc., 2216 East 56th Place, Tulsa, OK 74105 (918-749-9894) Worldwide 2, 10

Doug Brown Enterprises, Inc., 1703 East Skelly Drive, Tulsa, OK 74105 (918/747-3618) Worldwide 1, 3, 5, 9, 10, 11

Delcom Corp., 6019 S. 66th E. Ave., Tulsa, OK 74145 (918-494-9500; outside OK-800-331-5461) Continental U.S. 2, 3, 5, 8, 9, 10

OREGON

Environmental Container Systems, Inc., Box 188, Grants Pass, OR 97526 (503-476-8871) U.S.A. and Canada 8

Custom Video Systems of Oregon, Inc., 1965 S.W. 5th Ave., Portland, OR 97201 (503-295-6963) OR 1, 2, 3, 5, 8, 9, 10, 11

United Radio Supply Inc., Box 14040, Portland, OR 97214 OR, WA 3, 6

Videosonics Inc., 821 Southeast 14th Ave., Portland, OR 97214 (503-232-4632) ID, MT, OR, WA 1, 2, 3, 5, 7, 8, 9, 10, 11

PENNSYLVANIA

P.A.G.E. Co., R.D. 8, Box 41, Allentown, PA 18104 (215-395-3456) DE, DC, MD, NJ, NY, OH, PA, VA 4, 8, 9

Dimension Five Sound Co., 139 Montgomery Ave., Bala Cynwyd, PA 19004 (215-668-8260) DE, DC, NJ, NY, OH, PA, VA 1, 3, 5, 9, 10

Peirce-Phelps, Inc., 490 S. St. Johns, Camp Hill, PA 17011 (717-761-0240) U.S.A., GU, PR, VI 1, 2, 3, 5, 7, 8, 9, 10, 11

Radio Systems Inc., 5131 W. Chester Pike, Edgemont, PA 19028 (215-356-4700) U.S.A. but primarily CT, MD, MA, NJ, NY, PA, RI, VA 1, 4, 10

LPB Inc., 28 Bacton Hill Rd., Frazer, PA 19355 (215-644-1123) CA, CT, DE, DC, GA, ME, MD, MA, NJ, NY, NC, OH, PA, RI, SC, VA, WV 1, 3, 4, 10

Richard S. Pass Associates, Inc., 27 Oxford Dr., Langhorne, PA 19047 (215-757-6100) DE, DC, MD, Southern-NJ, Eastern-PA, VA 1, 2, 3

Lerro Electrical Corp., 3125 N. Broad St., Philadelphia, PA 19132 (215-223-8200) DE, DC, MD, NJ, PA 1, 2, 5, 8, 10

Peirce-Phelps, Inc., 2000 North 59th St., Philadelphia, PA 19131 (215-879-7171) U.S.A., GU, PR, VI 1, 2, 3, 5, 7, 8, 9, 10, 11

Steinberg Electronics Inc., 2520-22 N. Broad St., Philadelphia, PA 19132 (215-223-9400; 800-523-0894) Worldwide 1, 2, 3, 5,

(See page 211 for key to listings)

Cercone Vincent Associates, Inc., 2741 Noblestown Road, Pittsburgh, PA 15205 (412-922-0901) 1, 2, 10, 11 2, 7, 10, 11

Electromedia, Inc., 610 Melwood Ave., Pittsburgh, PA 15213 (412/683-5424) DC, MD, NY, OH, PA, VA, WV 1, 2, 3, 5, 9, 10, 11

Val-Tronics, Inc., Penn Park Bldg., Pittston, PA 18640 (717-655-5937) U.S.A. 1, 3, 4, 5, 6

Processing Plus, Inc., 59 Brookside Rd.; Box 3303, Suite 110, Wescosville, PA 18106 (215-398-3377) National 1, 3, 4, 5, 6, 9, 10

EMCEE Broadcast Products, Box 68, White Haven, PA 18661 (717-443-9575) Worldwide 4

Dimension Five Sound Co., 24 N. 3rd St., Womelsdorf, PA 19567 (215-589-2546) DE, DC, NJ, NY, OH, PA, VA 1, 3, 5, 9, 10

RHODE ISLAND

WRH Productions, 5 Industrial Way, Riverside, RI 02915 (401-434-6272) CT, ME, MA, NH, NY, RI, VT 1, 4, 5, 10, 11

TENNESSEE

Broadcast Equipment & Supply Co., Inc., Box 3141, Bristol, TN 37620 (615-878-2531) U.S.A. 1, 4, 5

Gray Communications, 6339 E. Brainerd Rd., Chattanooga, TN 37421 (615-894-6860) TN 2, 5, 8, 9, 10

Centel Systems, Inc., 3675 New Getwell Rd., Suite 12, Memphis, TN 38118 (901-365-1361) AR, MS, TN 1, 2, 5, 9, 10

Phase Audio, Inc., 151 N. Angelus, Memphis, TN 38104 (901-726-1900) U.S.A. 1, 3, 9, 10

Gray Communications, 225 Spence Lane, Nashville, TN 37210 (615-883-9175) TN 2, 5, 8, 9, 10

Redwood Marketing, 820 Redwood Dr., Nashville, TN 37220 (615-331-4743) North and South America 1, 3

TEXAS

Midcom, Inc., 2231 E. Division, Arlington, TX 76011 AZ, KS, LA, NM, OK, TX 1, 4, 5, 9, 10, 11

Broadcast Systems Inc., 8222 Jamestown Dr., Austin, TX 78758 (800-531-5232) U.S.A. 1, 2, 3, 4, 7, 8, 9, 10

Gene Sudduth Co., Inc., 5675 Roadrunner Lane, Beaumont, TX 77708 (713/899-1341) AR, LA, OK, TX 1, 2, 3

See advertisement on this page

Jenel Corp., Consulting & Engineering, 10307 Bernardin, Dallas, TX 75243 (214-680-0502) U.S.A. 8, 10

MZB&Assoc., 4203 Beltway, Dallas, TX 75234 (214-233-5535) AR, LA, NM, OK, TX 1, 2, 3, 4, 5, 7, 8, 9, 10, 11

Victor Duncan, Inc., 2659 Fondren Dr., Dallas, TX 75206 (214-369-1165) U.S.A. and Canada 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Professional Audio Services, Box 1953, Ft. Worth, TX 76101 (817-451-7643; 800-433-7668) U.S.A. and Canada 1, 3, 5, 9

See advertisement on this page

MZB&Associates, 16502 Northchase Dr., Suite E, Houston, TX 77060 (713-448-0881) AR, LA, NM, OK, TX 1, 2, 3, 4, 5, 7, 8, 9, 10, 11

Tenicki & Associates, 5719 Kirby, Suite 17, Houston, TX 77005 (713-528-2005) AR, LA, OK, TX 1

Fitzco Sound, Inc., 204 N. Midkiff, Midland, TX 79701 (915/684-0861) U.S.A. 1, 2, 10

The Gene Sudduth Co., Inc., Box 1116. Paris, TX 75460 (214-785-5764) AR, LA, OK, TX 1, 2, 3

See advertisement on this page

Allied Broadcast Equipment, 1201 East 15th, Suite 309, Plano, TX 75074 (214-423-8667) Worldwide 1, 3, 4, 5, 6, 9, 10

SAVCO, Box 427, Richardson, TX 75080 (214-234-1841) AL, AR, KS, LA, MI, MO, OK, TX 1, 2, 3, 4, 5, 7, 10

Abadon/Sun., Inc., Box 6520, San Antonio, TX 78209 (512-824-8781) U.S.A., Mexico 1, 2, 3, 5, 9, 10, 11

CFA-Media Specialties, Inc., Box 34567, San Antonio, TX 78233 San Antonio-512-657-5997; Dallas-214-644-6479; Houston-713-528-6012 LA, NM, OK, TX 1, 2, 9, 10, 11

Linrose Electronics Corp., 202 W. Nakoma, San Antonio, TX 78216 (512/342-8849) Worldwide I, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

UTAH

RIA, Inc., 50 E. Malvern, Salt Lake City, UT 84115 (801-486-8822 or 484-1701) AZ, CA, CO, ID, LA, MS, MO, MT, NV, OK, TX, UT, WY 1, 2, 3, 4, 5, 7, 8, 9, 10, 11

VIRGINIA

Broadcast Equipment Exchange, Box 1238, Arlington, VA 22210 (703-525-0400) U.S.A. and Int'l. 11

Hoppmann, Box 601, Chantilly, 22021 22151 (703-631-2700) U.S.A. 1, 2, 7, 10

David Green Broadcast Consultants Corp., Box 590, Leesburg, VA 22075 (703-777-8660) North America 1, 3, 4, 5, 6, 9, 10, 11

Alpha Audio, 2049 W. Broad Street, Richmond, VA 23220 (804/358-3852) DC, MD, NC, VA, WV 1, 5, 10

Old Dominion Broadcast Eng. Service, 1101 Front St., Richmond, VA 23222 (804-321-4506) Worldwide 1, 3, 4, 5, 6, 9, 10, 11

Midwest Corp., Communications Systems Div., 1395 Air Rail Ave., Virginia Beach, VA 23455 (804-464-6256) AL, DE, DC, GA, MD, NC, SC, VA 1, 2, 4, 5, 8, 9, 10

WASHINGTON

IGM Communications, 4041 Home Rd., Bellingham, WA 98226 (206-733-4567) U.S.A. 1

Allied Broadcast Equipment, 1112 South 344th St., Suite 312, Federal Way, WA 98003 (206-927-4337) Worldwide 1, 3, 4, 5, 6, 9, 10

Custom Video Systems, Inc., 17521 15th Ave. N.E., Seattle, WA 98155 (206-365-5400) AK, WA 1, 2, 3, 5, 8, 9, 10, 11

MARCOM, 216 Westlake Ave. N., Seattle, WA 98109 (206-621-9633) AK, AZ, CA, HI, NV, OR, WA 1, 2, 3, 4, 6, 10, 11

Northwest Broadcast Systems, 1718 N.E. 98th St., Seattle, WA 98115 (206-525-6974) AK, ID, MT, OR, WA 1, 4, 10

WISCONSIN

Full Compass Systems, Ltd., 6729 Seybold Rd., Madison, WI 53719 (608/271-1100; Outsdide WI-800/356-5844; WI-800-362-5445) U.S.A. 1, 3, 5, 9, 10, 11

Electronic Industries Inc., 19 E. Irving Ave., Oshkosh, WI 54901 (414-235-8930; 800-558-0222) U.S.A. 1, 3, 4, 5, 6, 9, 11

Video Images, 12200 W. Adler Lane, West Allis, WI 53214 (414-475-0111) WI 1, 2, 5, 7, 9, 10, 11

CANADA

Dilor Industries Ltd., 37749 2nd Ave.; Box 2169, Squamish, B.C., Canada V0N 3G0 (604-892-9301) Canada 2

Interlake Audio Inc./Fostex Electro Acoustics Systems, 620 King Edward St., Winnipeg, Man., Canada R3H 0P2 (204-775-8513) North America 1, 10

Glentronix (1977) Ltd., 160 Duncan Mill Rd., Don Mills, Ont., Canada M3B 1Z5 (416-444-8497) U.S.A. and Canada 1, 2, 3

Comad Communications, 91 Kelfield St., Unit 5, Rexdale, Ont., Canada M9W 5A3 (416-245-1734) Canada 1, 2, 4, 5, 9, 10

Caveco Equipment Ltd., 1121 Bellamy Rd. N., Unit 10, Scarborough, Ont., Canada M1H 3B9 (416-438-6230) Canada 1, 2, 3, 4, 5, 6, 9, 10

Black & McDonald, 101 Parliament St., Toronto, Ont., Canada M5A 2Y7 (416-366-2541) Canada 4

Lumitrol, Ltd., 5 Walker Ave., Toronto, Ont., Canada M4V 1G3 (416-921-6060 or 921-6688) Canada 2, 10

Studio Systems, Inc., Box 67, Snowdon, Montreal, Que., Canada H3X 3T3 (514-861-7448) AR, CT, DE, DC, FL, GA, IL, IN, KS, KY, ME, MD, MA, MI, MS, MO, NH, NJ, NY, NC, ND, OH, PA, SC, TN, TX, VT, VA, WV, all Canada 1, 2, 4, 5, 8, 10

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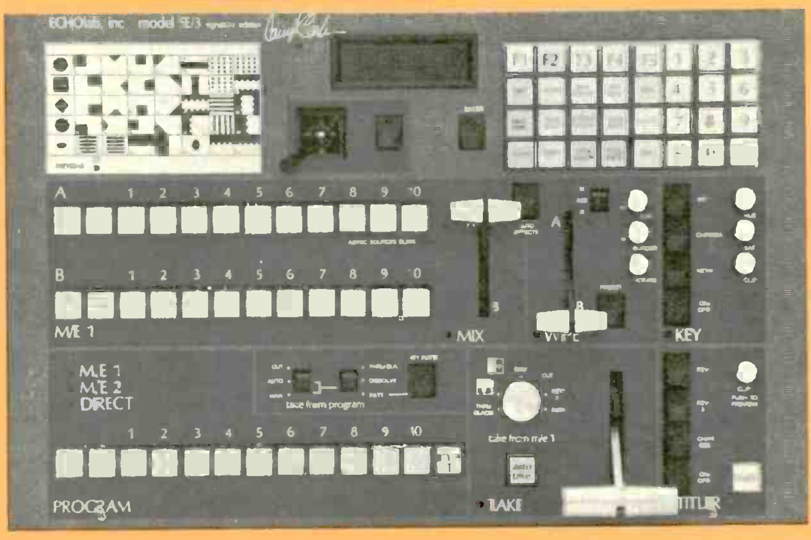

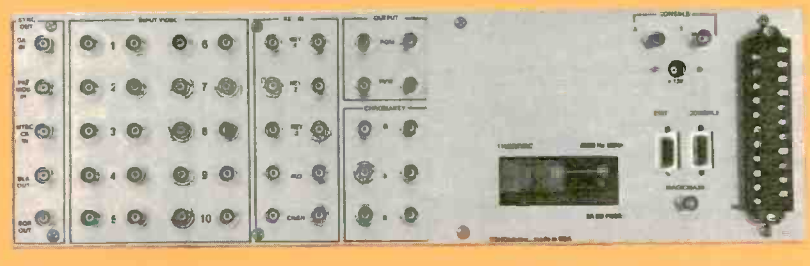

SE/3 rear panel. Note edit port at right. A standard 9-pin connector supports full RS-422 or RS-232C communication to 38K Baud.

Now, directly from the keyboard of your editing controller, you can mix, wipe, dissolve, key and produce complex transitions. Through either standard or optional interfacing, ECHOlab's SE/3 μP-controlled production switcher can add a new level of sophisticated capability to virtually any inexpensive editor.

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This means that even your most complex edit can be set up, frame accurate, entirely from the editor keyboard.

For example, a simple animation sequence might involve moving a bordered square across the screen in 67 frames while at the same time dissolving in a colorized key, then rotating the bordered square into a diamond as it wipes back across the screen. This sequence can easily be set up from the edit list and executed from the editor with no manual adjustment of the switcher.

For more advanced edits, complex multiple transitions can be preprogrammed into the SE/3's 5000 steps of programmable memory and remotely sequenced or randomly accessed from the editor.

The serial-editing interfaces are fully self-contained in the switcher electronics package, and require no external computer equipment. The typical setup requires only a 5-wire interconnecting cable between the switcher and edit controller.

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SE/3 with Contact Closure Interface	**$14,000**
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For details, write or call:

The ECHOlab SE/3 SEG fully complies with the new FCC regulations concerning radiation and interference for CLASS A commercial equipment, as described in the FCC rules and regulations Part 15, Subpart J of Docket 20780.

ECHOlab, Inc.

175 Bedford Road, Burlington, MA 01803 (617) 273-1512

Circle (165) on Reply Card

Ampex adopts Matsushita's video format

Ampex Corporation recently announced that it has adopted the ½-inch *M-format* video recording format for professional broadcast ENG applications, and will begin marketing worldwide a ½-inch integrated camera/VTR system this fall.

The M-format, developed by Matsushita Electric Industrial Company of Japan and adopted by Ampex, uses the ½-inch VHS videotape cassette in the single camera/VTR combination.

"Ampex has been evaluating systems and, as a manufacturer of both the VHF and Beta format cassettes, has determined that VHS is the superior cassette for the professional market," said Donald V. Kleffman, vice president/general manager, Ampex Audio-Video Systems Division.

Ampex will initially market the VTR system produced by Matsushita. However, Ampex intends to begin manufacturing its own version of the ½-inch system using the M-format in the future. Ampex exhibited the new integrated camera/VTR system in Brighton, England, at the International Broadcasters Conference in September.

The Ampex unit is designed to interface with existing studio equipment and can produce broadcast quality signals superior to that currently realized on ¾-inch VTRs. The Ampex system is comprised of an in-camera VTR, studio editing VTR and electronic editing control system.

The VTR and camera lock together to form a self-contained system allowing the operator to cover news action without need for connecting cables, shoulder straps or pack frames. The Ampex unit is compact and weighs less than 22 pounds.

In addition to the VHS cassette advantages, Ampex has selected the VHF format because of its superior capabilities in picture quality. The M-format recording system delivers broadcast quality video, two high quality audio tracks, plus control track and a SMPTE time code track, all on ½-inch tape.

The Ampex camera/VTR is capable of recording up to 20 minutes on one VHS cassette, and uses four video recording heads to produce high quality pictures. The new 2-track system records Y, I and Q information on separate video tracks and the I and Q signals are multiplexed for freedom from intermodulation, one of the common problems of *color under* ENG recorders. The system is complete with a built-in SMPTE time code generator.

The Ampex system uses microprocessor-based circuitry to provide automatic functions. Controls on the camera/VTR lens start and stop the record function. The 3-tube camera provides the choice of ⅔-inch Saticon or Plumbicon tubes. Special features of the camera include automatic beam control, 2-line vertical aperture corrector, black stretch and corner registration circuitry.

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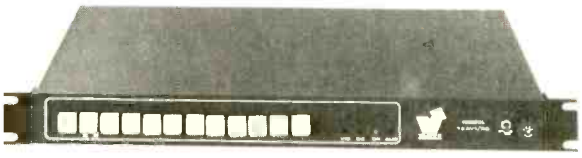

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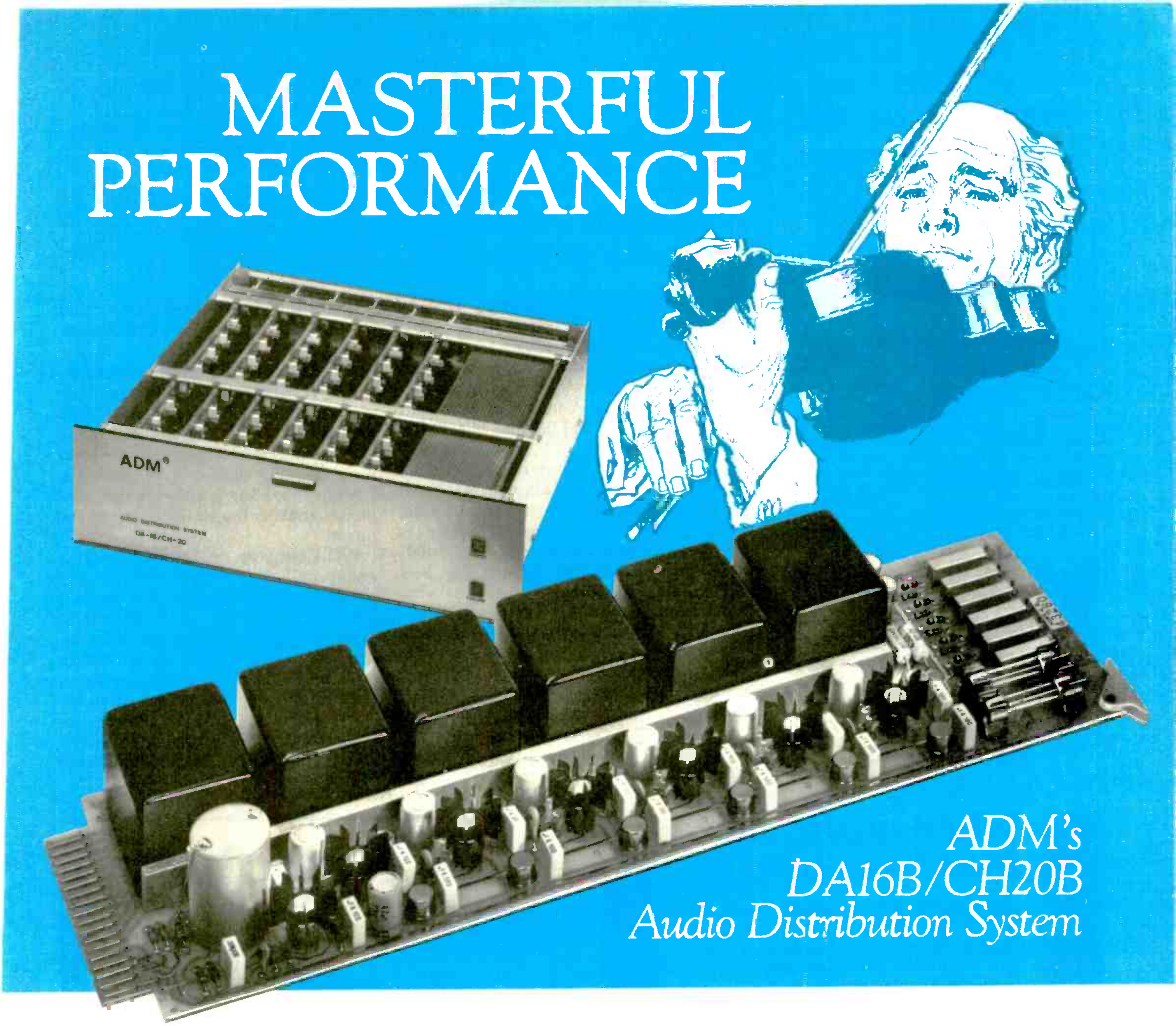

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production. Featuring complete direct-drive operation, the VTR scanner, capstan and reel motors all use dc motor servomechanisms. The Ampex ½-inch VTR accomplishes head switching in the vertical interval, and has dub capability.

The Ampex system's electronic editing controller offers advanced features for fast and accurate editing. Large search dials on the controller provide easy selection of edit points on each machine, and the digital displays show the selected entry/edit points for effective remote operation.

CMX 340X installed at Turner Broadcasting

Turner Broadcasting Systems has completed installation of a CMX 340X videotape editing system at its production center in Atlanta for use with Super Station WTBS and the Cable News Network.

In addition to interfacing with a Grass Valley 300 switcher, the 340X will be used with the station's VPR-2s, and with the CMX general purpose interface, the Quantel DPE-5000, Chyron character generators, and audiotape machines.

Via Video opens for business

Via Video of Cupertino, CA, features a blend of video and computer technologies. One product offered is the System One videographic computer design system, which features fonts, keyed backgrounds, electronic slides and illustrated storyboards, in more than 4000 colors.

JVC announces name change

US JVC Corporation has recently restructured its sales and service division by consolidating the marketing and support services under the new name of JVC Company of America. Greater flexibility in meeting the company's goals is the stated intent of the move.

JVC Company of America markets audio and video equipment to the public and professionals. The product line, manufactured by Victor Company of Japan Ltd., ranges from individual components to complete systems and includes stereo receivers, turntables, speakers, video cameras and recorders, TV monitors, accessories and recording tape. Stereo sound systems for cars and vans were

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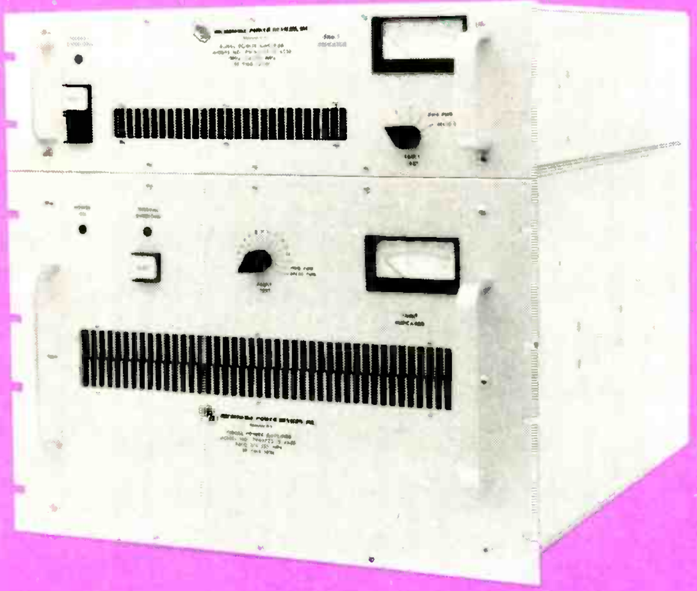

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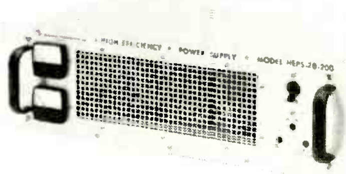

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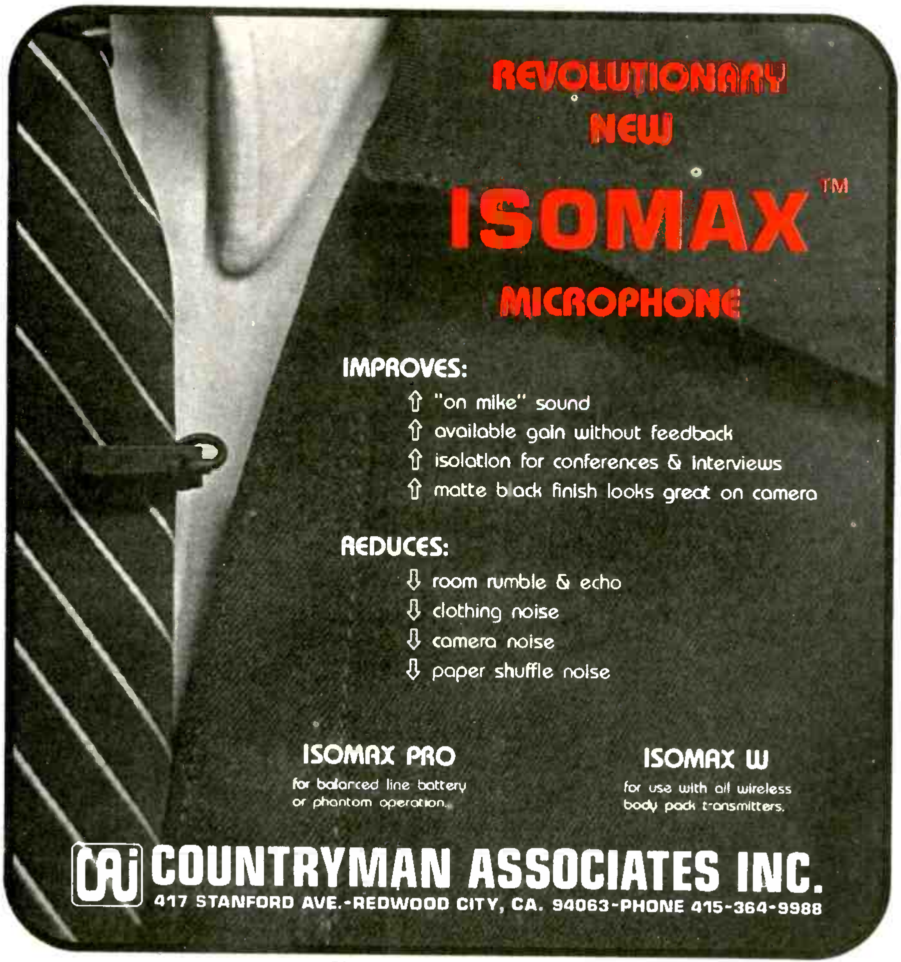
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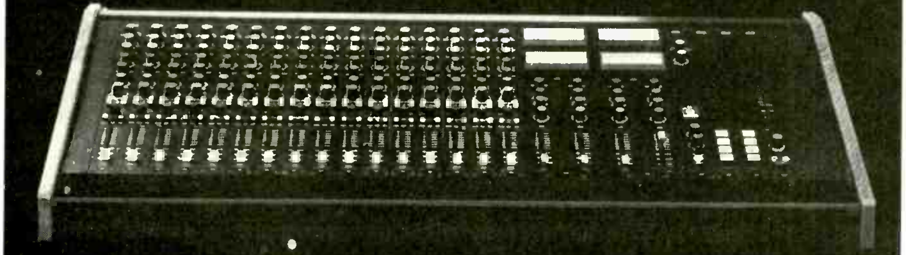

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recently added to the product line.

Asaca/ShibaSoku relocates corporate headquarters

Asaca/ShibaSoku Corporation of America has opened its new corporate headquarters in Los Angeles. The entire company, including the sales, engineering and management staff, is located at one site instead of maintaining separate offices in Des Plaines, IL, and New York.

The 10,000-square-foot facility houses a complete engineering design department, a customer service department where orders are received and billed, and a warehouse from which all shipments are made.

The office of Takashi Shigezaki, company president, is located at the new facility along with the offices of Kazuo Ezue, director of engineering, and Alan R. Davis, director of marketing.

In addition to establishing its warehouse and new corporate sales and marketing offices in Los Angeles, Asaca/ShibaSoku plans to establish regional spare parts and service facilities at various locations across the United States.

The new address is 12509 Beatrice St., Los Angeles, CA 90066; 1-213-827-7144.

Swedish broadcasters purchase MCI consoles

Sveriges Radio A B has become a major customer of MCI, a division of the Sony Corporation of America. Two years ago, Swedish broadcasters approached the south Florida manufacturer for specialized consoles to be used by both radio and television. The MCI JH-600 series of audio mixing desks met their needs. The Swedish engineers' requirements included high sonic performance and human-engineered control layouts.

With close cooperation between MCI engineers and Swedish Broadcasting's technical staff, the desks incorporate modifications especially suited to European broadcast requirements. Among the special features on these boards are special monitoring facilities with tally lamps, tape returns expanded to nine stereo pairs, and auxiliary inputs expanded to eight stereo pairs. An NTP/PPM program meter and a Goniometer (x-y scope display) have been provided in addition to the JH-600's standard VU metering on mix and channel outputs. These auxiliary meters can be used to monitor any of a number of console outputs via a *wink-eye* switch located in the meter housing. A digital clock/timer is also built in to the meter housing right above the PFL speaker, and MCI's standard *broadcast option* provides true PFL functions, special

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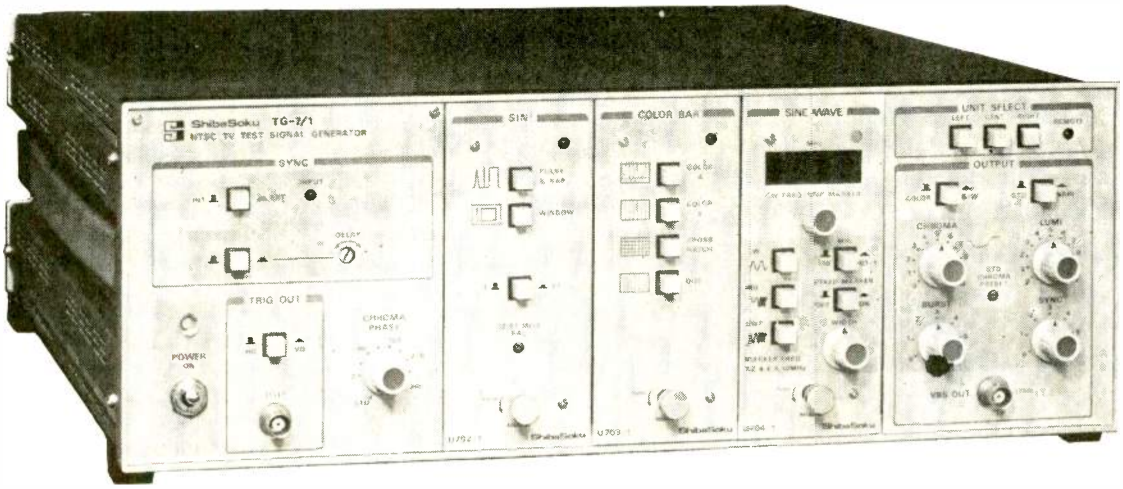

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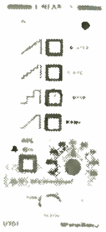
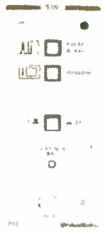
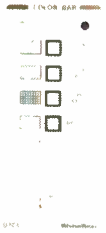

U701
LINEARITY
UNIT


U702
SIN²
UNIT


U703
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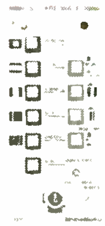
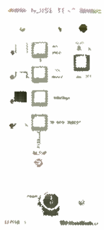
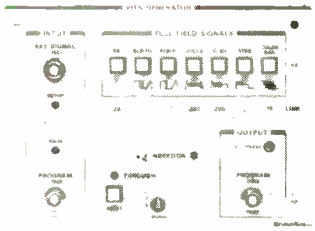
UNIT

U704
SINE WAVE
UNIT


U705
SQUARE WAVE
UNIT


U706
NOISE TEST
UNIT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- Independent output terminals provide video component, sync signal, color burst level signals to be connected to an external programmable attenuator, each output level can control with external signals independently.
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- Switches provided on the front panel enable selection horizontal or vertical drive for a trigger pulse output.
- The maximum variety of test signals can be generated with the minimum number of modules.
- Optional IEEE-488 Bus unit provides automated program control.

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signal routing and monitoring.

The wood trim has been changed from MCI's standard South American rosewood to red oak to match the decor of Swedish Broadcasting's control rooms.

MCI has delivered more than 20 consoles to the Swedish Broadcasters so far, and more are on order, including a customized version of MCI's JH-652.

Pioneer to provide BC-2000s for Vision Cable

Pioneer Communications of America has signed a 17,500-unit contract with Vision Cable Communications. Vision, headquartered in New York City, purchased Pioneer's BC-2000, 36-channel set-top converter for use in its Pineville, LA, cable TV system. Shipment of converters by Pioneer will be completed this month.

Otari sets up new R&D division

Otari Corporation has established a new research and development division. The new research facility, which features the latest test equipment and listening environments, is being constructed adjacent to Otari's US headquarters in Belmont, CA.

Steve Krampf will be general manager and Tom Sharples will be engineering manager.

Radio networks sign up for RCA's distribution service

RCA American Communications has recently announced that ABC, CBS and NBC radio have signed contracts to use its satellite-transmitted Audio Digital Distribution Service (ADDS) for radio program distribution to affiliates. The collective value of the three contracts totals $46.5 million over eight years.

Through the use of ADDS, a single network can distribute any number of high quality radio programs simultaneously on a nationwide or regional basis. Receiving stations may select alternate channels of programming, as desired, or stations may receive two or more programs simultaneously. Network expansion is achieved by adding more channel units to existing stations, while new stations can become part of the network by installing small, inexpensive, 3m receive-only antennas.

ADDS service is configured in units of 15kHz or 7.5kHz audio channels for program distribution, and 30kbit/s data channels for network coordination and hard-copy transmission. Generally, the 15kHz channels are used for stereo music programming while the 7.5kHz channels are used for news services.

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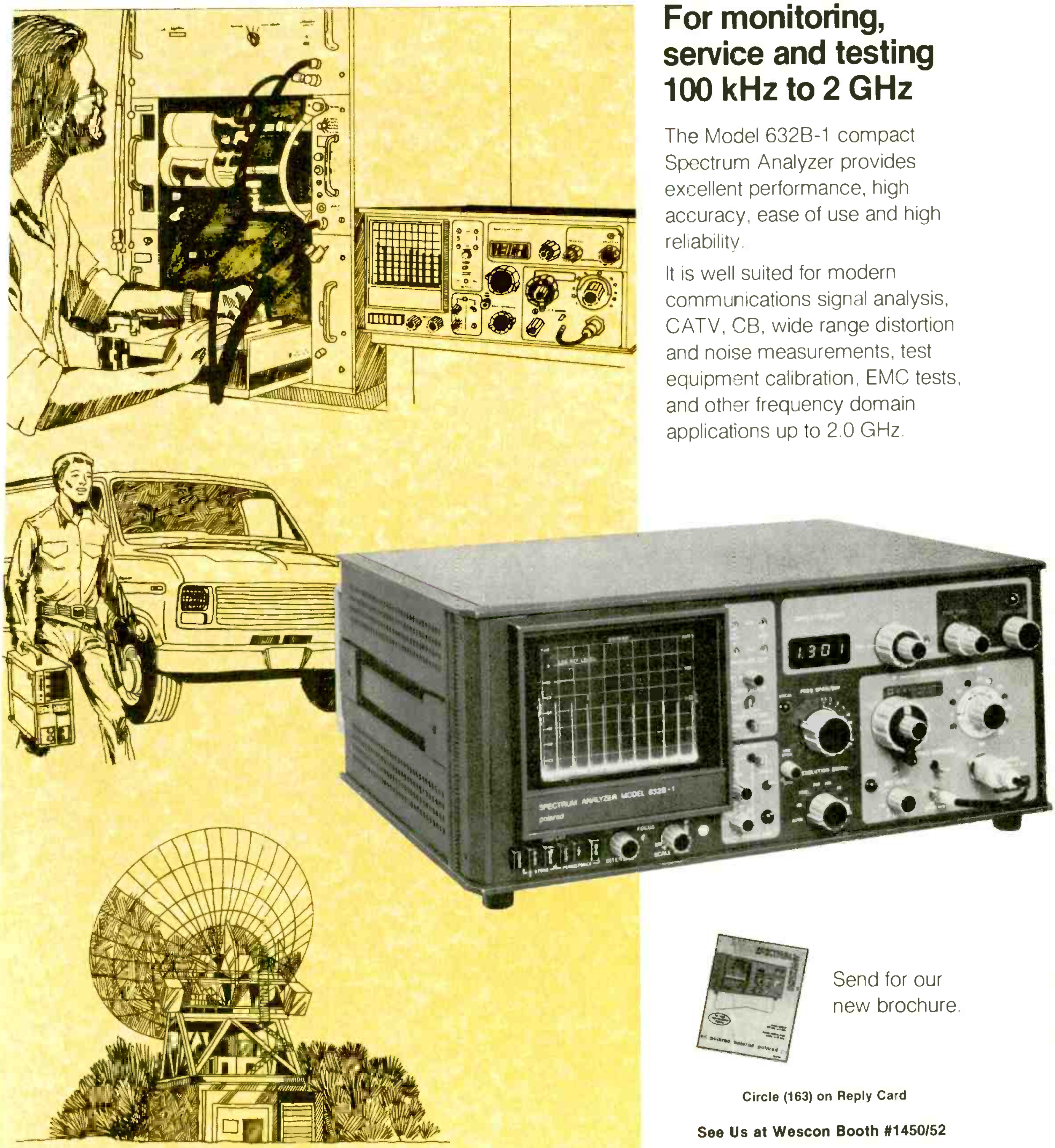

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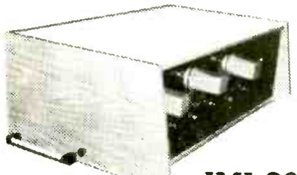

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NBC will begin in the first quarter of 1983, and CBS will begin in the third quarter of 1983. Service will be initially carried over Satcom I, moving to Satcom I-R later in the contract period. RCA American estimates that about 4500 earth stations will be receiving ADDS programming by the mid-1980s.

Hoffman Video expands

As part of a major expansion now under way, Hoffman Video Systems has announced plans to establish a branch sales office in Irvine, CA.

The 4000-square-foot complex, located in the new industrial complex on 17752 Mitchell St., will house a full video sales staff and complete servicing, rental and demonstration facilities.

The telephone number for the new Hoffman Orange County facility is 1-714-660-1066.

ALCOA-NEC formed

Aluminum Company of America and Nippon Electric Company Ltd. of Japan recently formed a new corporation to assemble and market TV receiver systems that will make it possible for individual homes and apartments to obtain TV programming directly from broadcast satellites.

The new company, ALCOA-NEC Communications Corporation, is owned 51% by Alcoa and 49% by NEC. The new company will draw upon the resources of Alcoa in the manufacture of aluminum and NEC in the manufacture of telecommunications equipment, computers and semiconductors.

The home TV receiving systems are designed to receive signals from a new generation of direct broadcast satellites to be launched in the mid-1980s. Each unit will contain three basic pieces of equipment: a 0.75m-1.8m aluminum parabolic dish to receive the 12GHz satellite signal; a low noise converter (LNC) that changes the signal to a lower frequency for transmission over coaxial cable; and a receiver/demodulator that enables the signal to be received on a home TV screen.

Until the new direct broadcast satellites are operational, ALCOA-NEC Communications Corporation will work closely with broadcasters and others who are preparing to enter the field to supply equipment for early entry systems receiving programming from conventional satellites. The company will have headquarters in Elk Grove Village, IL, and will assemble, test and ship the antennas/receiver systems at an existing facility in Sidney, OH.

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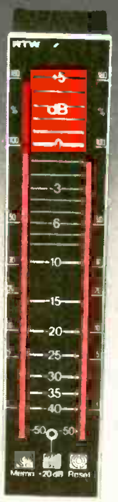

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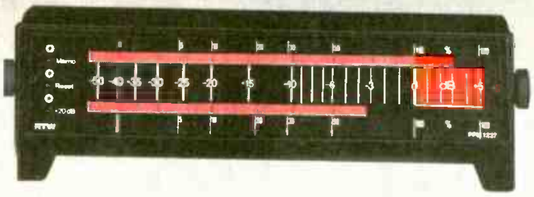

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Advanced electronic design and innovative packaging make it all possible. Our routing switcher—even the smallest 10 x 10 version—has an integral 100 x 100 digital control system with unique packaging and bussing to permit simple expansion without the need for recabling or retiming the existing system.

Good specs that stay good

The TVS/TAS-1000 has excellent performance specifications. Crosstalk, for example, is rated at —60dB under worst possible conditions. And we've designed it to stay that way by confining sources of crosstalk to individual boards. Complexities of installation or aging of components won't affect it. You can expect performance to be consistent. From switcher to switcher. From year to year.

And unlike most switchers, crosstalk in the TVS/TAS-1000 does *not* increase as matrix size increases. This means you can expand your system—in your facility—without decreasing performance.

We check our specs with the industry's most precise automatic testing system. We test all possible signal paths for each measurement. In the case of crosstalk, we measure twice—using two possible worst case selection patterns—and we record the poorer reading.

You get a complete copy of all test data. We keep a copy on file at the factory.

Controls for all requirements

We can offer you more than a dozen different rackmount and desktop control panels for your TVS/TAS-1000 so you can operate the system *your* way. The CP-1500, for example, offers full-matrix control with alpha-numeric displays for quick identification of all sources and destinations. It connects to the switcher matrix via a single coax "party line."

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Want to expand your system even further? You can add dynamic machine selection with our Fernseh TCS-1 machine control system and control up to 100 VTRs, film chains, and related units.

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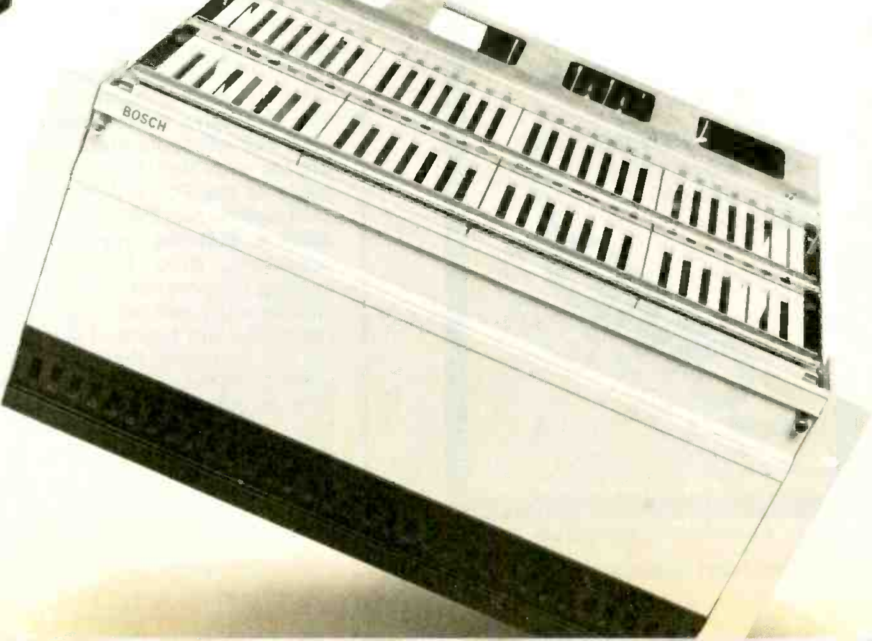
BOSCH



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associations

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Fritts

Fritts elected president

Edward O. Fritts, president, Fritts Broadcasting, Indianola, MS, was recently elected president of the NAB. Fritts succeeds Vincent T. Wasilewski, who earlier this year had announced his intention to retire upon the naming of a successor. At press time, a starting date for Fritts' term had not been announced.

Fritts, who will be the association's 19th president, was in his second term as chairman of NAB's Joint Board. Elected to the Radio Board of Directors in 1977, he was its 1979-80 vice chairman and 1980-81 chairman. Fritts is a former chairman of NAB's Small Market Radio Committee. He was a member of the association's Radio Code Board and an advisory trustee of the Television and Radio Political Action Committee. He also is a former president of the Mississippi Broadcasters Association.

Fritts comes from a broadcasting family. He started his career as a part-time announcer for WENK, Union City, TN. His broadcasting group includes WNLA AM/FM, Indianola, MS; WELO and WZLQ, Tupelo, MS; KMAR AM/FM, Winnsboro, LA; KCRI, West Helena, AR; and KCRI-FM, Helena, AR. He is affiliated with his father, Edward B. Fritts, in ownership of WPAD and WDDJ, Paducah, KY.

Auxiliary facility changes favored

The NAB recently expressed qualified support for proposed rule changes that would produce greater flexibility in the use of broadcast auxiliary equipment and frequencies. The Federal Communications Commission is considering changes in three categories that govern TV auxiliary broadcast stations: studio transmitter

NAB briefs

The NAB extends its congratulations to the American Bar Association on the decision of its House of Delegates to repeal a 45-year-old attempt to prevent radio, TV and still photographic coverage in courtrooms.

The Executive Committee of the NAB has asked its staff to file an appeal with the US Court of Appeals of the FCC's June 23 decision authorizing DBS.

William Stakelin, executive vice president, Blue Grass Broadcasting Corporation, Orlando, FL, was recently elected chairman of the NAB Joint Board of Directors. He will complete the term of Edward O. Fritts, who was recently elected president of the association.

A significant victory for the NAB occurred recently with the court decision prohibiting AT&T's entry into the electronic publishing and advertising business. It was argued that AT&T's entry would create grave First Admendment and anti-competitive abuses. The decision blocks AT&T's entry into electronic publishing for at least seven years, and then only after "the risk of its domination of that field has abated."

The FTC has been asked by the NAB to temporarily suspend enforcement of its rule that prevents food and gasoline retailers from using radio and television to advertise games and sweepstakes promotions. The request states that the rule unfairly discriminates against radio and TV licensees who compete with print media for the advertising of these retailers.

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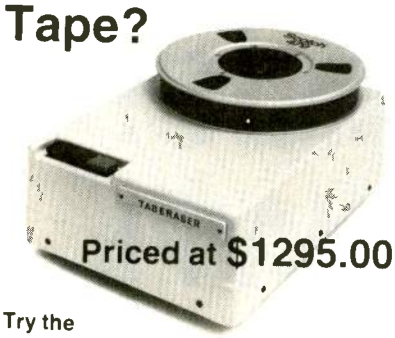

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links, TV intercity relay stations and TV pickup stations.

The amendments would accomplish the following:

- end restricted facility use to only licensees and allow auxiliary broadcast station licensees to share their excess capacity with broadcast or non-broadcast entities;
- permit expanded use of multiplexed audio signals by eliminating limitation of their use to broadcast stations owned by or under common control of the licensee of the auxiliary station; and
- substantially deregulate licensing policies to reflect actual commission staff practice of the past several years.

The NAB said that the rules must provide that the broadcast-related uses for which Subpart F frequencies were originally allocated must continue to be the primary uses of the frequencies and facilities. It also recommended that the *50% limitation* (current rules limit use of the facilities for non-broadcast-related purposes to 50% of the time) be retained for mobile facilities to avoid interference problems.

The association also said that a priority system is essential, with STL and cable TV relay service links first (except backup or alternative); interci-

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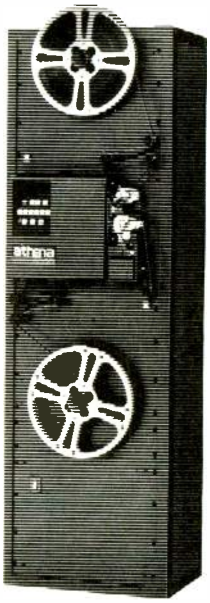

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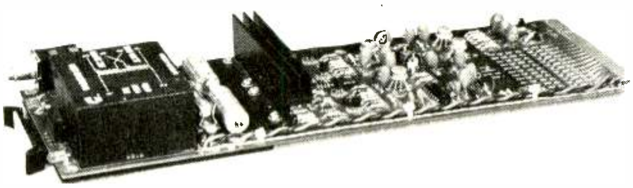

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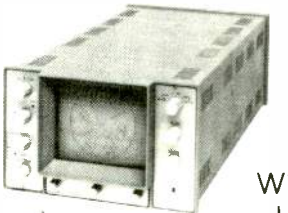

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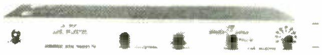

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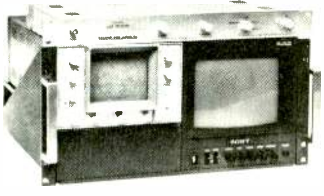

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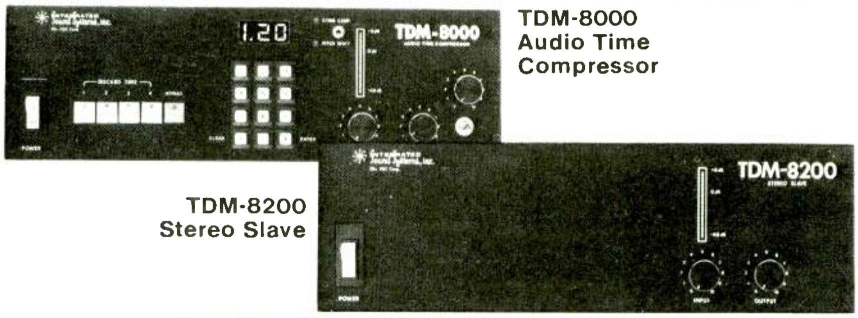

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ty relays second; TV pickups and translator relays third; and fixed links outside the service area fourth. It said the rules should provide flexibility in the application of the priority system by local coordinating committees and the FCC.

TV financial survey shows healthy growth

The annual financial survey conducted by the NAB of the US TV stations shows that in 1981 the typical station had a pre-tax profit of $1,064,000, a 12.6% increase over the previous year. The survey was based on replies from 436 stations and showed an increase in all categories.

Gross time sales increased 15.7% to $5,739,100, and net revenues were up 16.7% to $5,066,300. National and regional spots accounted for $2,634,200, an 18.75% climb, and local advertising increased by 13.9% to $2,605,600. For the first time since 1970, the typical station received more advertising dollars from national/regional spots than from local advertising. Network compensation came in at $499,300, a 9.35% jump.

Non-broadcast revenue hit $117,200 (15.70%) and $129,100 (33.09%) for trade-outs and barter transactions.

Operating expenses rose 17.8% to $4,012,100 with programming costs the leader at $1,484,500, up 22.75%. Behind that was general and administrative ($1,500,500, 14.72%), selling ($576,200, 16.7%) and technical ($442,200, 14.6%).

The survey also shows that the typical station spent $33,800 on outside news service, $81,900 on music license fees and $384,000 on film and tape. There were 78 full-time employees at the average station, up from 71 in 1980.

Appeals court asked to reverse Copyright Tribunal decisions

The NAB has asked an appellate court to direct the Copyright Royalty Tribunal to award additional copyright fees to TV stations for sports broadcasts and to require the tribunal to award funds to commercial radio broadcasters.

At issue is the Tribunal's refusal to award 1979 cable royalties for stations' copyright interests in telecasts of sports events and no royalties whatsoever for commercial radio broadcasters. The NAB said that TV broadcasters should be awarded an additional 5.5% of the royalty fund as authors and copyright owners of 36.5% of sports telecasts or at least 2.75% of the royalty fund as joint authors of the telecasts. Also, the association said the court should reverse the Tribunal's refusal to award commercial radio broadcasters any

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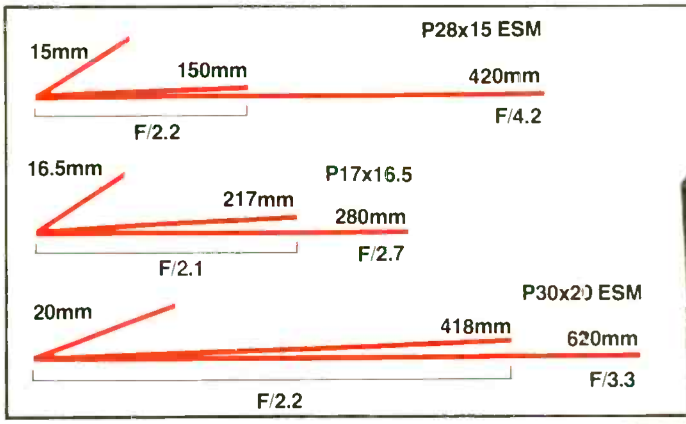
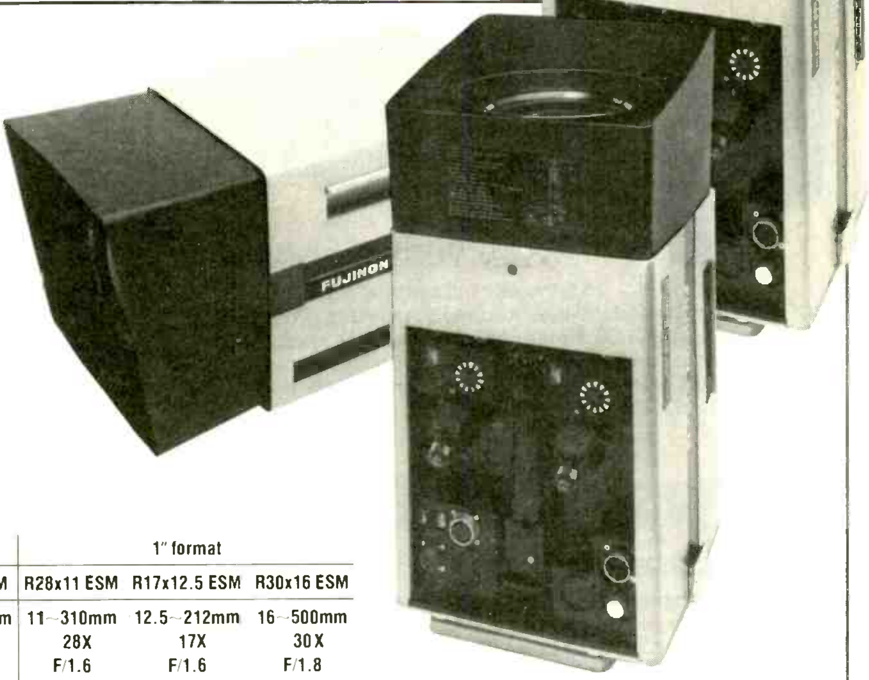
For more information on the newest and finest BCTV lenses, and why they are the best performance investment for your new or existing cameras, contact Fujinon. Large format zoom lenses are another reason why the world sees itself more clearly through the eyes of Fujinon.





Specifications:

	1¼" format			1" format		
	P28x15 ESM	17x16.5 ESM	30x20 ESM	R28x11 ESM	R17x12.5 ESM	R30x16 ESM
Focal Length	15~420mm	16.5~280mm	20~620mm	11~310mm	12.5~212mm	16~500mm
Zoom Ratio	28X	17X	30X	28X	17X	30X
Max. Aperture	F/2.2	F/2.1	F/2.2	F/1.6	F/1.6	F/1.8
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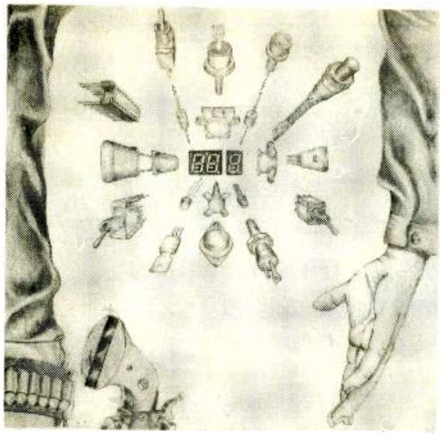

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royalties and direct it to make an award based on evidence submitted to the Tribunal.

NRBA

National Radio Broadcasters' Association

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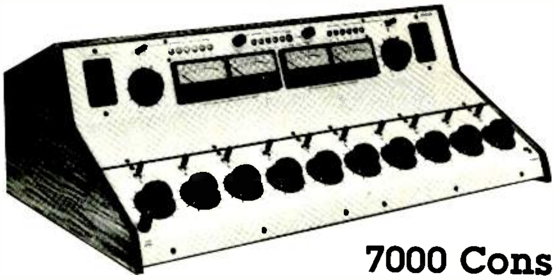
Kaplan writes open letter to broadcasters

Dear radio broadcaster:

There has been a great deal of publicity recently concerning radio's prospects for legislative deregulation, and specifically about NRBA's supposed *pursuit* of a plan that would give broadcasters long-term license contracts in exchange for financial support of public and non-commercial radio. An NAB spokesman was recently quoted as characterizing this idea as a "pipe dream that holds commercial broadcasters hostage." I want to set forth some simple facts about NRBA's efforts toward securing real legislative deregulation, about the so-called public radio trade-off and about who is really pursuing a pipe dream.

- The NRBA favors legislative deregulation including the Cannon Bill (S–1629) already passed by the Senate and various bills on the House side, including the Collins Bill (H.R. 5242) and the Broyhill Bills (H.R. 5584-5585).
- The Cannon Bill includes license fees that can be raised by the Congress as time goes along.
- Congressman Tim Wirth, chairman of the House Energy and Communications Subcommittee on Telecommunications, has made it clear that he opposes Cannon's Bill and the aforementioned House bills. Rep. John Dingell, chairman of the Energy and Commerce Committee, supports Wirth's position on the subject of radio deregulation. Without Wirth's and Dingles' support, the passage of a deregulation bill in the House is extremely unlikely.
- Congressman Wirth has indicated possible support for a plan to extend license periods for 40 to 50 years, on a contractual basis, in exchange for a fixed 1% of the gross revenues with such revenues targeted to support public radio and non-commercial radio. Such a contract fee could not be



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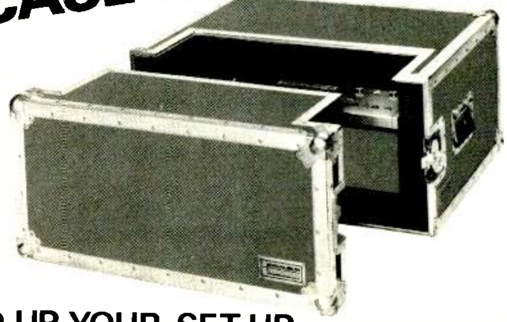

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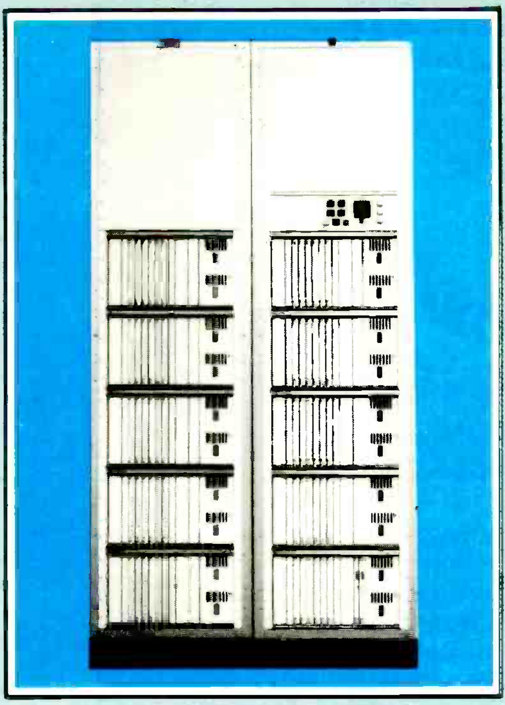
OUR SWITCHER SPECS SPEAK FOR THEMSELVES

ollowing is a summary of test data compiled from the final test neasurements made on a 50-input by 50-output audio/video witching matrix sold to Capital Cities' Houston outlet KTRK-TV. Ve invite comparison of these test results with our published pecs and with the published specs of routing switchers nanufactured by others.



50 x 50 KTRK MATRIX

KTRK TEST DATA BREAKDOWN

	Worst	Mean	95th Percentile	Published Spec	
VIDEO					
Crosstalk @ 3.58 MHz	−63	71.1	65	−60	dB
Diff Gain	.05	.042	.05	0.1%	
Diff Phase	0.1	.056	.08	0.12°	
Diff Delay	1.0	.89	.95	± 1°	
Freq Response	.05	.02	.05	±.12	dB
Hum & Noise	−79	−84.6	−80	−75	dB
Gain Uniformity, All Paths	.017	.006	.017	±.07	dB
Input Return Loss	46	51.2	46	40	dB
Output Return Loss	45	48.8	46	40	dB
AUDIO					
Crosstalk @ 20 KHz	−80	−84.7	−81	−75	dB
Hum & Noise	−88	−91.8	−90	−85	dBm
THD 30 Hz - 20 KHz					
@ 0 dBm	.017	.011	.015	0.1%	
@ +24 dBm	.24	.13	.17	0.5%	
Gain Uniformity, All Paths	0.1	.044	.09	0.2	dB
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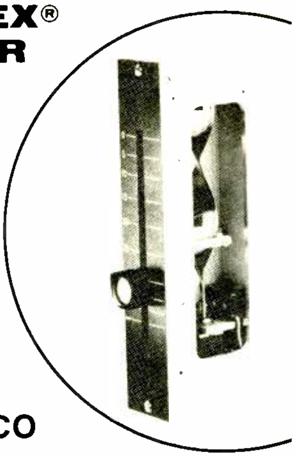

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raised by Congress during the life of the contract.

- This plan would encompass a far greater degree of radio deregulation than the Cannon Bill (S–1629).
- The NRBA does not endorse this plan to the exclusion of other possible avenues of legislative relief, but maintains that it would be irresponsible not to pursue any meaningful proposal for obtaining the radio broadcasters' common goal.
- Given the political realities, rejecting this plan out of hand, while relying instead on bills that may be unattainable would be in our view "chasing a pipe dream."
- The opportunity to achieve legislation will never be better, but the hour is growing late, and if we do not seize the opportunity, we may not get it again in the foreseeable future.
- The FCC deregulation of today could be changed by the courts and/or the next administration. One-and-a-half years ago, we had a very different FCC. That FCC of old, or an even more oppressive FCC, could return.

As president of NRBA, I intend to continue our discussions of the various proposals with all of the key people involved. We will, in short, continue to work diligently on your behalf and hope that when we have found our way through the maze, we will find genuine legislative rewards awaiting us.

Sis Kaplan
NRBA president

SMPTE

862 Scarsdale Ave.
Scarsdale, NY 10583
1-914-472-6606

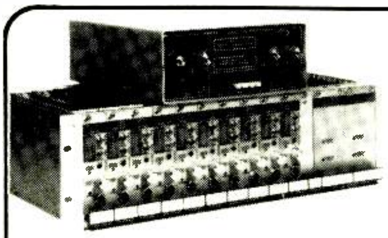
SMPTE working group reviews standards

The SMPTE Working Group on Standards for ½-inch VCRs for Broadcast Applications held its sixth meeting in May in Chicago. The initial submission for a format standard from RCA, Matsushita, Ikegami and Hitachi was reviewed by the group. Results of the review were that the initial proposed format should be capable of meeting the user requirements.

For more information, contact A. Alden at the SMPTE headquarters.

Chairmen named for NY conference

New committee chairmen for the



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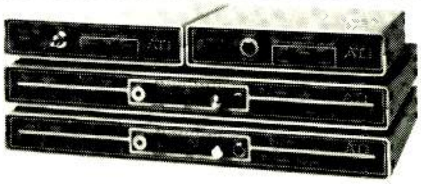

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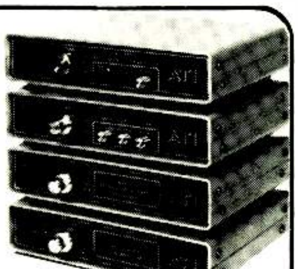

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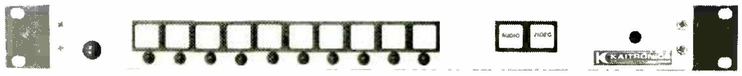

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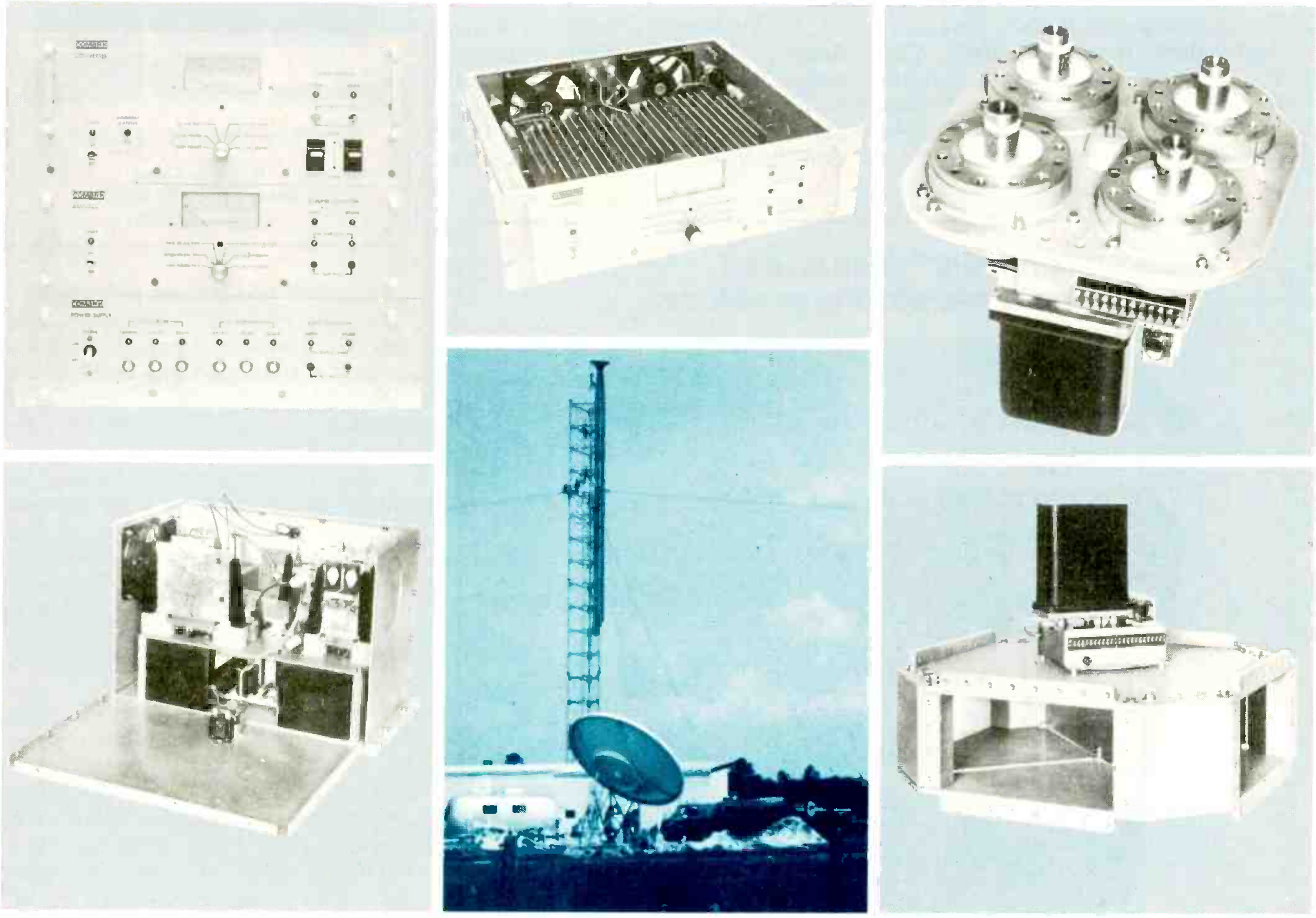

From Melbourne, Florida to Imo/Plateau, Nigeria, Comark supplies turnkey TV systems and components to support broadcasters throughout the world. In fact, we manufacture more of the components that make up a total UHF TV transmission system than anyone else. Our field operations capability provides turnkey services for both transmitter modernization and new station installations.

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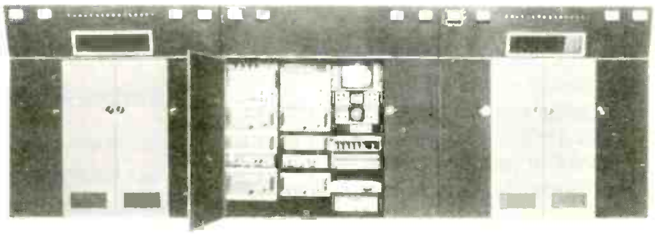

Comark 55 kW UHF Transmitter

COMARK

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SMPTE Conference, to be held Nov. 7-12, 1982, at the New York Hilton in New York City, have been appointed. Alvin J. Siegler, CBS, was named local arrangements chairman and will be responsible for overall arrangements of the conference not relating to the program.

The specific arrangement committees and their respective chairmen are: Hotel Arrangements, Edward J. Burns, Eastman Kodak Company; Registration, Irving Rosenberg, CBS TV Network; Membership, Martin Bunnel, United Nations; Entertainment, Albert Arbeeny, Hazeltine Corporation; Hospitality, Neal Pilzer, Motion Picture Enterprises; Security, Robert M. Smith, Du Art Film Labs.; Administrative Assistants, William L. Cooper, Jr., William L. Cooper, Inc.; and Carmine Melignano, Price Waterhouse & Company.

Other chairmen are: Luncheons, Philip Godfrey, ABC Television Network; Audiovisual–TV, Alan J. Zauzmer, Ztronic Enterprises, Ltd.; PA and Recording, Earl F. Arbuckle, III, WPIX; Display, Arthur P. Willis, Eastman Kodak Company; Transportation, John B. Low, Motion Picture Enterprises; Finances, James Hannafin, Technicolor, East Coast Division; Banquet, Seymour Yusem, CBS-TV; and Banquet vice chairman, Jamie Ellis, Independent Producer.

The SMPTE conference will have five days of sessions on the technical aspects of motion pictures and television. Also, there will be a 300-booth exhibit featuring the latest motion picture and TV equipment.

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Arendall re-elected president

Ron Arendall of Indianapolis, IN, has been re-elected president of the Society of Broadcast Engineers for the 1982-83 term. Arendall is manager of engineering at WTHR-TV in Indianapolis.

Other officers gaining re-election include: Doyle Thompson of Atlanta, GA, director of engineering of The Weather Channel, vice president; Brad Dick of Lawrence, KS director of engineering at KANU/KFKU, secretary; and Ed Karl of Manchester, MO, engineer in charge of KMOX-TV in St. Louis.

Board members re-elected to their positions include Len Ballard, director of engineering, Swanson Broadcasting, Tulsa, OK; Ray Benedict, engineering manager, WHIO-TV, Dayton, OH; Hugh Cleland, chief engineer, WCNY-TV/FM, Syracuse, NY; and Roger Johnson, chief engineer, KOY Radio, Phoenix, AZ.

New board members elected to serve for the 1982-83 term are Robert Klein, director of engineering, Kentucky Educational Television, Lexington, KY; and Jack McKain, director of engineering, KCMO-TV/AM-FM, Kansas City, MO.

National frequency coordinating committee formed

The Society of Broadcast Engineers has announced the formation of a national SBE frequency coordinating committee chaired by Richard Rudman, engineering manager of KFWB in Los Angeles, who currently serves as chairman of the Southern California frequency coordinating committee.

Committee members include: Jack McKain, director of engineering, KCMO, Kansas City, MO; Ross Kauffman, operations and engineering director, WCVB, Boston; and Robert Van Buhler, chief engineer, KDKB, Phoenix, AZ.

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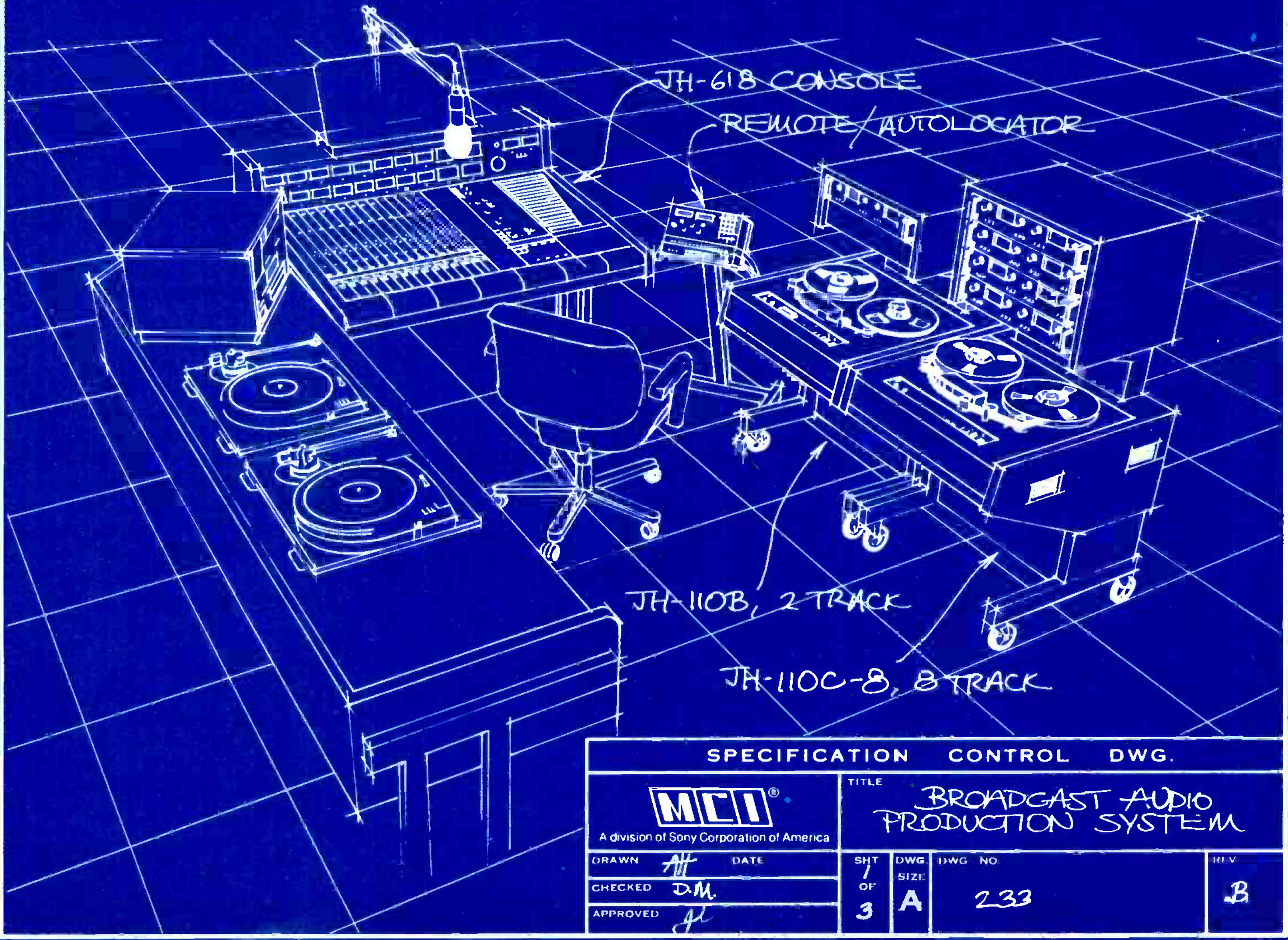

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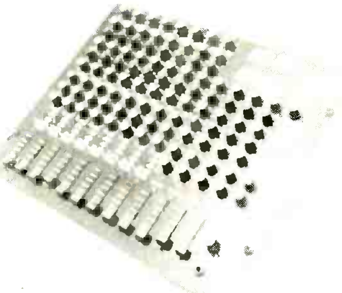

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new products

Battery belts

Portable Energy Products' new two-on-one sealed lead-acid battery belts can simultaneously power a video camera and a 100W sun-gun-type light. The belts are available for 12V and 14V video cameras.

Circle (452) on Reply Card

Earth stations

The *Microwave General* Star Trac line of earth station hardware includes the 4m antenna (shown) for video reception; the 5m and 6m versions; the RCP-1644 remote control panel for antenna orientation; and the remote control command center for satellite/channel selection, odd/even channel polarization selection and optimization, and fine tune/audio channel selection. Customer options include trailer mounting or fixed-base mounting.

Circle (464) on Reply Card

Microwave transmitter

Twelve-hour operation from a 9V battery at 7GHz or 13GHz is claimed for the *Household Data Services* FX-T1 microminiature microwave transmitter. The 2-ounce unit offers 10mW output RF power from the 2.1"x1.1" x0.325" package. Compatible receivers (the HDS GD series) complete an ENG link that does not require licensing.

Circle (454) on Reply Card

DA system, intercoms

Up to 10 model 2510 cards plug into the System 2500 audio distribution amplifier for 1-in, 6-out capability. The *RTS Systems* unit is a 19-inch rack-mount card cage with power supplies. It features balanced input and outputs.

Also from RTS Systems is a

24-channel intercom system, which can accommodate up to 100 RTS model RMS324 rack-mount speaker stations. Each unit provides switching and amplifying with interconnection by 25-pair cable.

Another product group, the series 17 user stations, forms a low cost conference line intercom system. The single-channel units interconnect on a 3-wire system and are compatible with the RTS TW equipment. The HND17 handset, HST17 single earphone headset and HCA17 amplifier assembly complete the system.

Circle (457) on Reply Card

Rack-mount timers

Chrontrol timers provide time-programmed control of up to 16 independent circuits used to operate devices such as tape or chart recorders, program switching, lights, sound distribution equipment, fans and compressors. They feature 40 optional programs.

Circle (458) on Reply Card

Identifier unit

The *Lang Video Systems* VAX-700 automatic video/audio changeover/identifier is an electronic 2x1 switcher that incorporates an NTSC color bar generator and a character generator. Features include a visual indication plus a resettable audible alarm warning to the operator when a fault is sensed.

Circle (459) on Reply Card

Vocal microphones

The *Philips* model 7401 dynamic cardioid microphone has an internal, locking on/off switch. It is available with a detachable cable in one of these variations: as the 7401E with XLR-XLR cable, 7401P with XLR-to-phone plug or the 7401T with XLR-to-H1-Z phone plug.

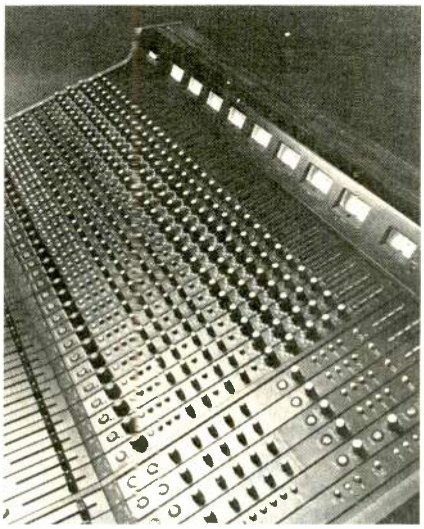
Circle (460) on Reply Card

Audio accessory system

The 1100 series system from *Auditronics* provides housing for a wide variety of accessories and is constructed to mount in a standard 19-inch equipment rack. Currently available are the DA-6 and DA-6LC audio distribution amplifiers, each providing six balanced outputs from one balanced input. The DA-6LC features wide frequency response to allow for the passage of SMPTE and EBU time code.

Circle (461) on Reply Card

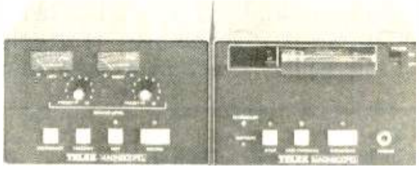
Sound mixer



The M1532 from *Yamaha* has 32 input channels, 13 mixing buses and 17 outputs. Each input channel has a pair of switch-selectable XLR connectors, either of which is usable with mic or line level sources.

Circle (462) on Reply Card

Broadcast cart machine



Telex's Magnecord MC-II comes in separate modules with the cart transport in one housing and the record electronics in another. The modules may be stacked for space savings. NAB and IEC equalization circuitry are featured.

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Standby and LPTV antennas

The TRASAR™ series antennas from *Andrew Corporation* are enclosed in a pressurized fiber glass radome for en-

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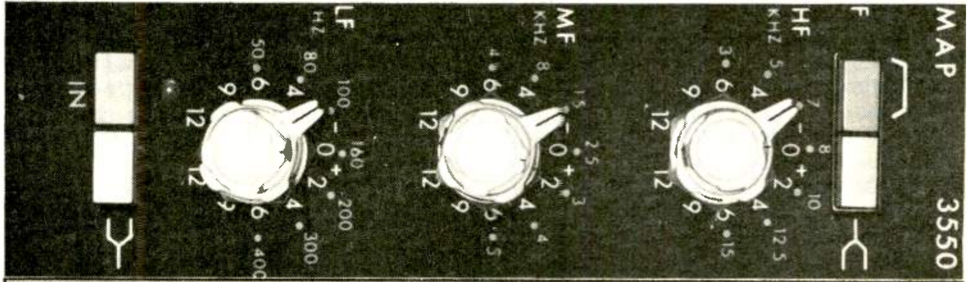

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vironmental protection and low windload. The first antenna in the series is side-mounted with a skull azimuth pattern.

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TV color analyzer

Minolta's TV Color Analyzer II is a microcomputer-based unit featuring a chroma mode that shows chromaticity coordinates and luminance in candelas or foot-lamberts. Four white standard/reference color memory channels and four CRT-matrix-characteristic memory channels enable white-balance adjustment of a variety of monitors for different markets.

Circle (463) on Reply Card

Editor interface

From *Industrial Sciences Inc.* comes the 920, which features an operator-selectable editor control or a 3-digit thumbwheel switch. Controls are arranged in four independently controllable sections.

Circle (465) on Reply Card

Custom modular consoles

Finntek Ltd.'s SX series consoles feature 8, 10, 16, 24, 28 and 32 mainframes. The consoles may be customized for films, radio, television, multimedia and cable. The SX 8 and 10 are audio generation mixers.

Circle (469) on Reply Card

Floppy disc drives

The FD-55 series from *TEAC Corporation of America* are 5¼-inch disc drives with band drive positioning using a direct drive dc brushless spindle motor in one enclosure. The series includes single-sided and double-sided, single- and double-density drives in 48- and 96-track-per-inch configurations.

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Repair system

The *Pace* PRC-151 standard system performs the following functions: temperature-controlled desoldering; abrading, milling, drilling and grinding for general PCB repair; removal of conformal coatings; high strength reflow soldering; thermal wire stripping and resistance heating capability. The system also features zero power switching.

Circle (471) on Reply Card

Media management system

The AMI microcomputer-based system from *Research Technology International* features reservation programs integrated with an accounts receivable/general ledger package. Also standard are programs for advance booking, special order entry and invoicing.

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Electronic crossover

The *Loft* model 403-M is a mono, 2-way, 18dB per octave electronic crossover. The 19-inch rack-mount unit offers continuously variable crossover frequencies from 40Hz to 12kHz.

Circle (473) on Reply Card

VCR, videocassette

The *JVC Company of America* HR-C3U compact lightweight recorder is about 60% smaller than previous portable videocassette recorders from the company. It weighs 4.4 pounds without battery pack. Twenty minutes of continuous recording is possible. The TC-20 VHS videocassette is used with the HR-C3U recorder. The TC-20 is less than one-third the size of a regular VHS videocassette. However, the C-P1U adapter allows the TC-20 to be used in a regular VHS VCR.

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Behind every great camera is a great battery

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Ikegami ITC-730 Camera

The Ikegami ITC-730 camera is yet another example of the Ikegami commitment to the highest standards of both quality and performance, combined with economy never-before-seen in a 3-tube prism optics camera.

Designed to satisfy the needs of industrial, cable and broadcast users, the Ikegami ITC-730 camera features the highest quality internal components available, low noise with high sensitivity, and an optional character display for function status readout. The ITC-730 is system compatible, shoulder molded, and well balanced—and can be purchased for under $10,000 complete with lens and Anton/Bauer battery.

Ikegami engineers realize that the battery is an integral component of the camera system. After designing a camera as reliable as the ITC-730, Ikegami required the highest quality, most reliable battery available. They chose Anton/Bauer.

In fact, Ikegami and every other camera manufacturer feature only Anton/Bauer Snap-On™ battery systems as standard equipment for all of their professional cameras.

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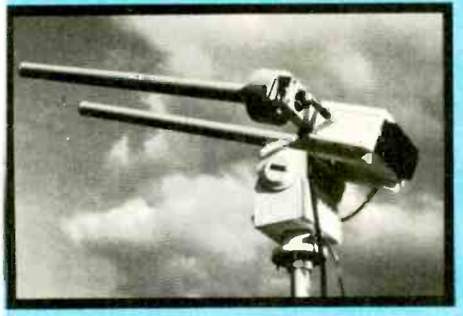
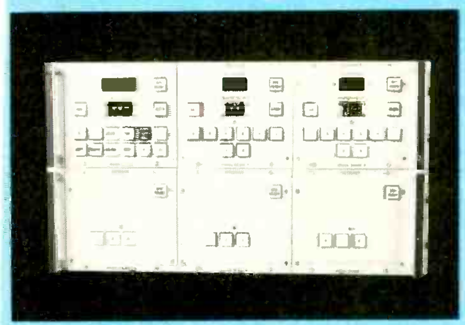
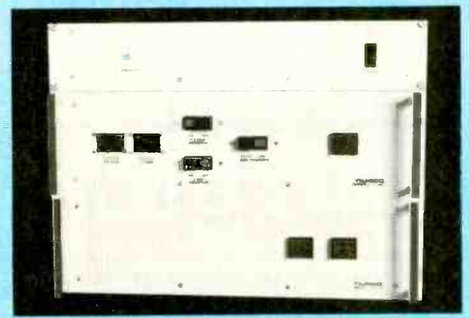


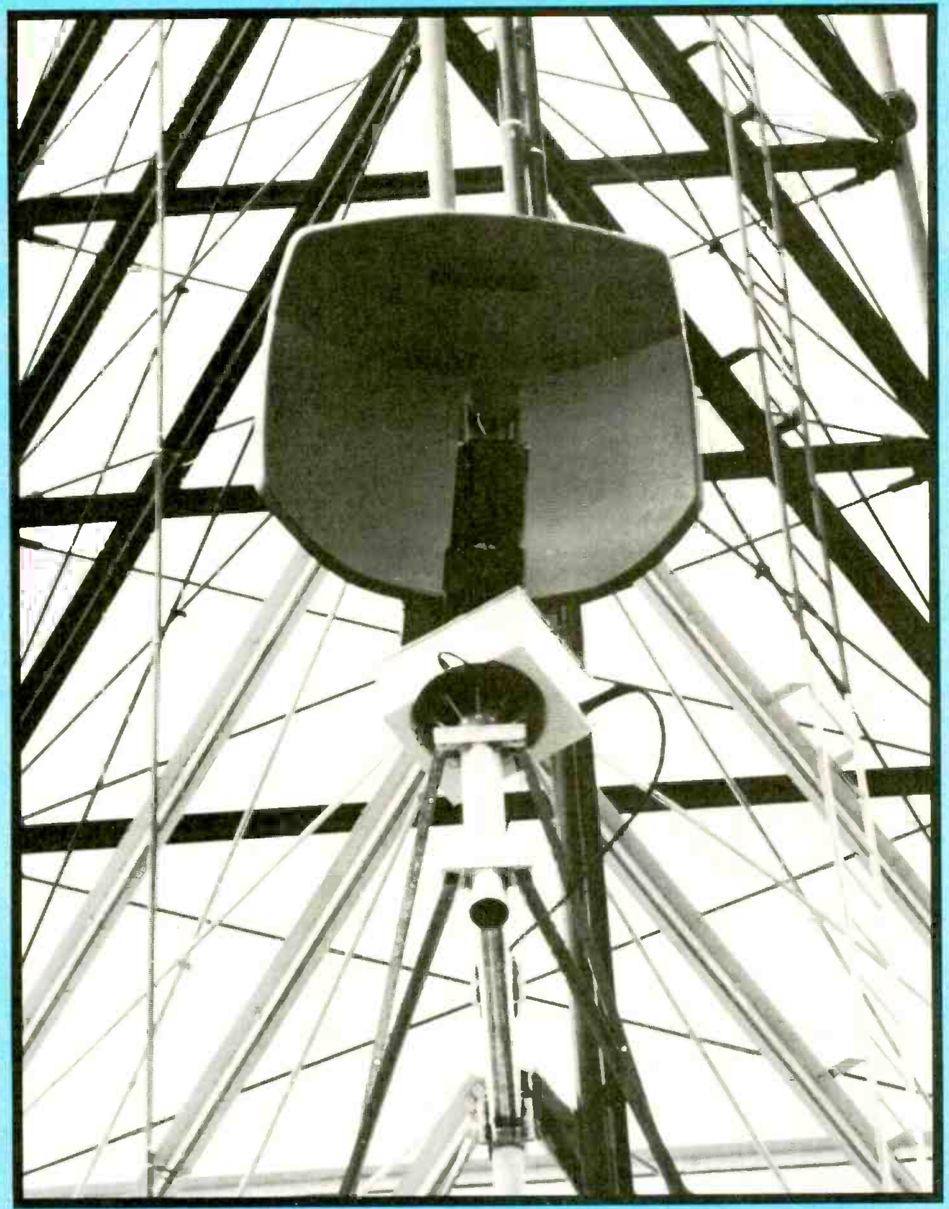
The DUALROD™ circularly polarized transmit antenna



The MC3 Digital Remote Control System



The Transponder Series of IF heterodyne transmitters and receivers



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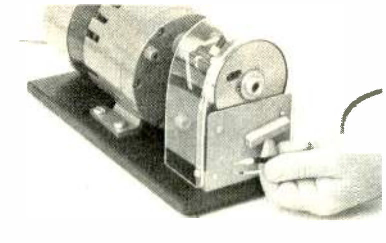

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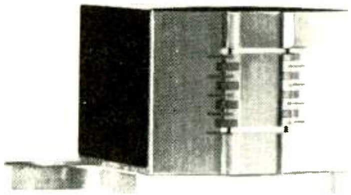

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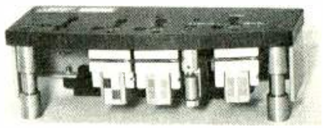

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station-to-station

End-of-tape alarm

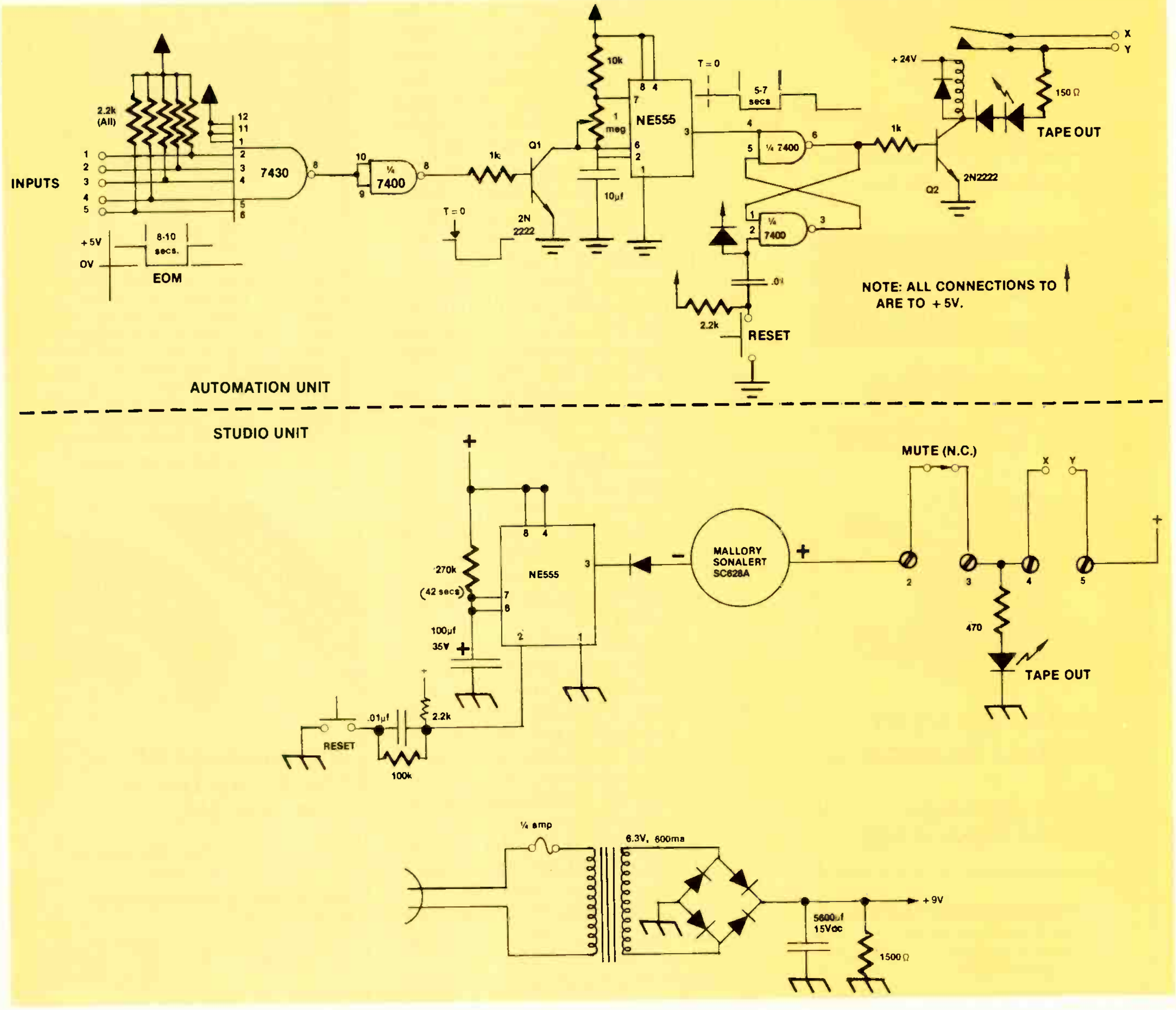
Robert Yankowitz
Chief engineer
WNYS-FM/WNBH-AM
New Bedford, MA

At WMYS, our automation runs unattended for a good part of the day. We have found that an end-of-tape alarm system helps avoid dead air, keeps the AM operator from making unnecessary trips to the automation, and makes sure that the music tapes run completely out before they are changed.

The circuit senses a tape-out condition by way of the 25Hz end-of-message tones. When a new tape arrives at the station, the WMYS production personnel process it (remove excess tape, add leader, etc.). As part of this processing they add a 10-second tone to the existing tone at the end of the last song. The end-of-tape circuit ignores the shorter EOM tones, but recognizes the long tone after the last song.

The unit installed in the automation works as follows. The tone sensors provide a normally high TTL level signal to the 7430, 8-input NAND gate. Under no-tone conditions (all inputs high), transistor Q1 is turned on, clamping pins 2 and 6 of the 555 to ground. This keeps the output of the 555 (pin 3) high. When a tone is sensed, the tone sensor output goes low and Q1 is turned off. With the clamp removed, the 555 becomes astable. Should the tone last long enough, the 555 output will go low, triggering the 7400 latch. If the tone is a normal EOM (2-4 seconds), Q1 will re-establish the clamp on pins 2 and 6, resetting the circuit. When the 7400 latch is set, Q2 is turned on, pulling in the relay and turning the "tape out" LED on.

The studio section uses a snooze-button-type circuit. When the relay contacts (from the automation unit) close, the *tape out* LED lights. A 555, set up as a monostable multivibrator, provides a normally grounded output, which allows the Sonalert to be activated. The operator can push his reset button, which sets the 555's output high for 42 seconds (in our case), turning off the Sonalert. At the end of the 42-second period, the alarm sounds again. The Sonalert is muted by the studio muting system. We have


INPUTS
1
2
3
4
5
2.2k (All)
12
11
1
2
3
4
5
6
7430
8
+5V
0V
8-10 secs.
EOM
10
9
¼ 7400
8
1k
Q1
T=0
2N 2222
10k
1 meg
10µf
8 4
7
NE555
6
2
1
3
T=0
5-7 secs
4
5
¼ 7400
6
1
2
¼ 7400
3
.01
2.2k
RESET
1k
Q2
2N2222
+24V
150Ω
TAPE OUT
X
Y
NOTE: ALL CONNECTIONS TO ↑ ARE TO +5V.
AUTOMATION UNIT
STUDIO UNIT
+
270k
(42 secs)
NE555
8 4
7
6
2
1
3
100µf 35V
.01µf
2.2k
100k
RESET
MALLORY SONALERT SC628A
MUTE (N.C.)
X
Y
2
3
4
5
470
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found that this grace period is valuable to the AM operators, particularly if they are caught running a commercial cluster or otherwise cannot leave the studio. When they can, they will change the tape and press the reset button on the automation unit.

Timer checks on automation

By Ken Blake
Chief engineer
KJOY-AM/KJAX-FM, Stockton, CA

The appeal of an automated programming system is that most of the time it runs without people. The minimum number of people are involved in programming and production, and rarely is anyone assigned to monitor every function so that errors can be corrected immediately. We had to solve a *people* problem that is experienced only by users of automation systems. The announcer on duty in our *live* AM operation is also responsible for loading the Ampex reproducers in the FM system. Many times the press of on-air duties causes a hurrying of tape loading calisthenics resulting in the malfunction for which the following solution was devised.

On the music reels, a 25Hz stop/transfer tone is recorded on only the *left* track following each selection. A hurried loading of the playback occasionally results in a half-twist of the tape as it comes from the supply reel. Two objectionable results are obtained; not only does the tape pass over the reproduce head upside down, causing a loss of high frequencies in the program being aired, but the 25Hz tone sails by undetected, because it passes over the *right* reproduce head. The tone is not fed to circuitry to use it for stopping at the end-of-selection and for starting the next event. The result is the airing of 90 minutes of continuous music from that reel without normal high frequency content and with no breaks for commercials or station IDs.

The automation system is not equipped to sense this extreme length of time consumed by one event as a malfunction. When the reel is finally empty, the system will silence-sense and start the events that are inserted by the pre-programmed memory causing to be aired *in succession* all the commercials, time signals and IDs that were missed during the previous 90 minutes of uninterrupted music Depending upon commercial load, there could be at least 10 to 15 minutes of talk events in one continuous grouping.

The solution involves the use of the timer diagrammed in Figure 1. When

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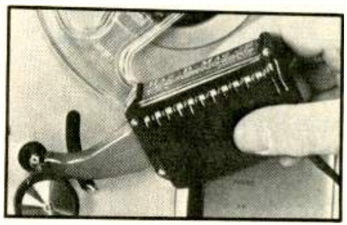

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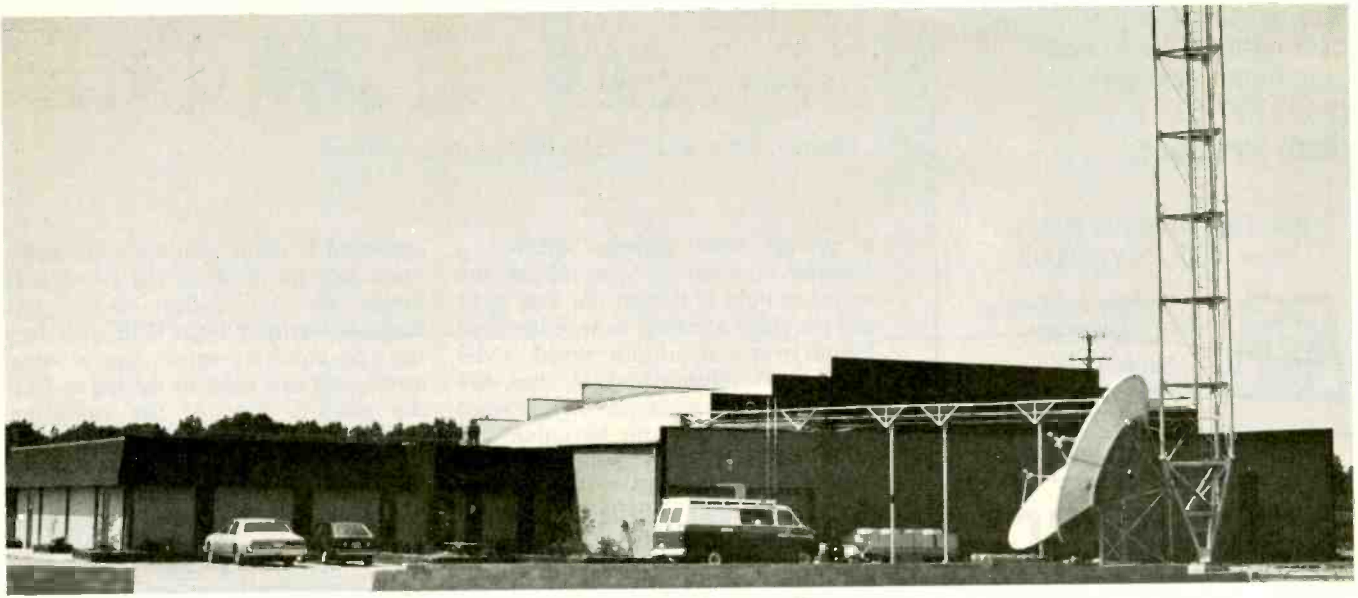

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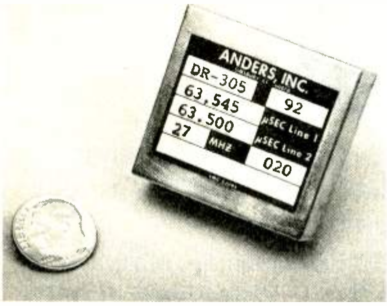

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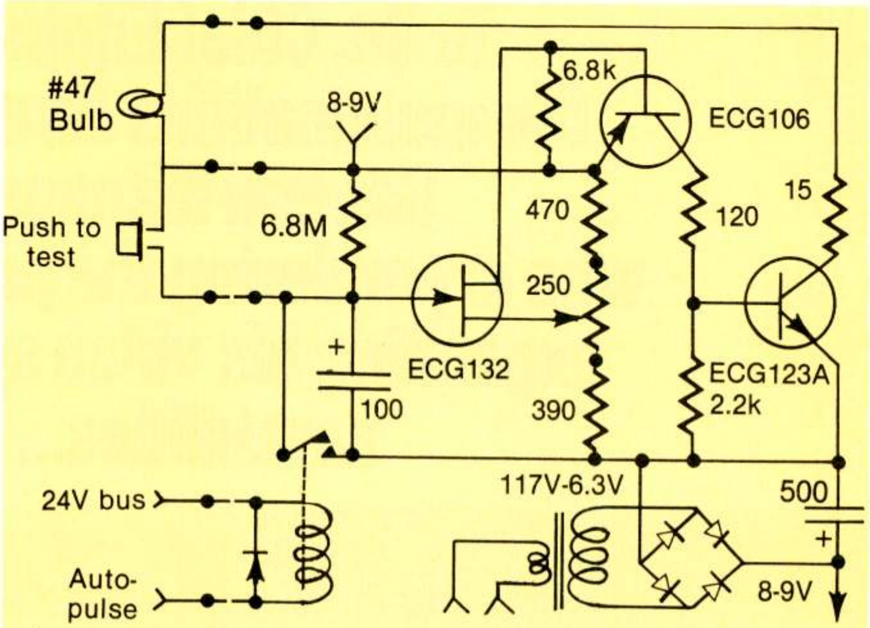

Figure 1. Automation segment timing checker circuit

a pre-set time elapses without a transfer tone having been sensed, the warning light is turned on. The 250Ω pot provides a means to vary the time length over a 10-minute period. A red "bull's-eye" (illuminated by the #47 bulb) and the push-to-test switch were connected to the unit by cable and mounted on a front panel for maximum visibility. The test switch assures that the bulb is OK. At the start of the next event, it is extinguished, when a new timing countdown is started. The 24V relay on the timer is activated by the *auto-pulse* occurring in the Schafer 903 each time a function is started. As our longest separate event is the 5-minute network newscast, the time was set for approximately four minutes. This provides an automatic self-test for the timing cycle, as the light can be observed to come on before the news ends. At the close of the news segment, the auto-pulse should extinguish the light. If the light is on during a period that a music tape is being aired, one can refer to the log to find the starting time of the operating deck. If an unreasonable amount of time is indicated, then the tape that is playing is the culprit and correction can be made. Alternatively, after having been warned by the light, one can note whether the tape institutes a transfer operation at the end of the selection being played, because a single composition may require more than four minutes.

The unit, in operation for two years, uses an FET and other discrete components as shown. Alternate timing approaches are available.

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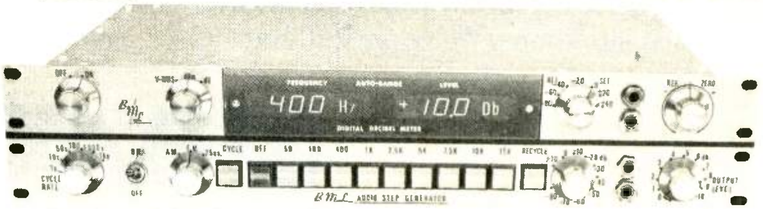

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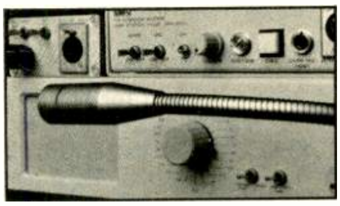

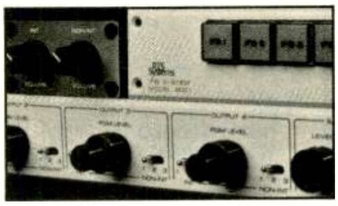

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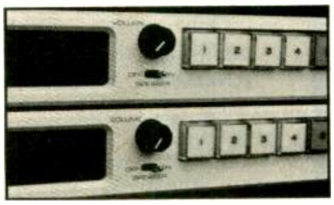

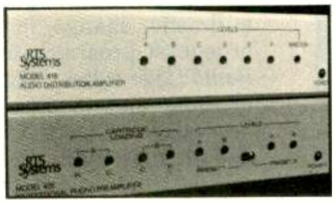

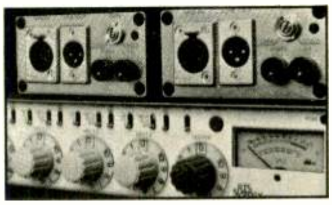

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feedback

Fight for freedom

I read and re-read "Broadcasting Freedom: The Battle Must be Won," in the June issue of **BE.** I can only say, "What a wonderful thing it must be to live and work in the United States." How I wish I had been born in this last bastion of freedom—rather than in the socialist hell that is quickly becoming the personification of Canada.

In July, our Canadian Radio—television and Telecommunications Commission (read: Thought Police) announced that it would hold hearings this month to see if a cultural pay-channel would be introduced on all our cable systems—the viewer would have to pay whether the service was wanted or not. Doubtless, an added feature of this horror will be its adaptability to watch the viewer, on behalf of our socialist government and its oppressive and repressive agencies.

For heaven's sake, please don't ever stop your fight to keep the United States free: Keep it a heaven of individual freedom and free enterprise, and don't (as we did here) let passivity and indifference allow it to become a collectivist hell, governed by, and at the whim of, socialist pseudo intellectuals.

At 45, with 28 years in broadcasting, my only prayer is that someday soon, the United States will open its doors to all of us who would, in a moment, flee this socialist cancer to become productive and thankful citizens of a free country.

Bruce Anderson
Program manager
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AM stereo/ local programming

The July **BE** editorial, "AM Stereo: A Shot in the Arm," expressed something that I have long felt. In fact, at the recent Ohio State University WOSU Broadcast Engineers Seminar, I discussed this topic at length with speakers and attendees.

One session concerned *broadcast audio*, but the discussion centered on AM stereo. My point was that arguing over improving the technology was putting the cart before the horse. Without improving program content, an improved signal will be form without substance, and a farce.

Before AM stereo becomes the hot thing, I agree with **BE,** we should see an improvement in receivers, education of the public about what they should look for in a good receiver, and a drastic change in the quality of broadcast programming. As the *NAB Radio Code* states: "Radio is a creative medium and is always striving for new ways to serve." You spotlighted one creative radio service in your excellent article about KABC and its nationwide TALKRADIO.

However, radio can also be an intimate medium for production of local events. Think of this...for the cost of a single ENG van for television, a radio station could put an *army* of engineer/producers in the field to cover local events.

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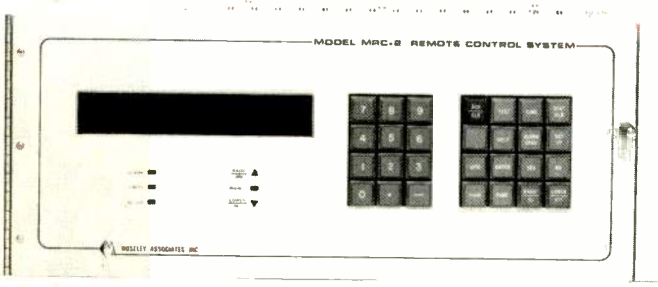
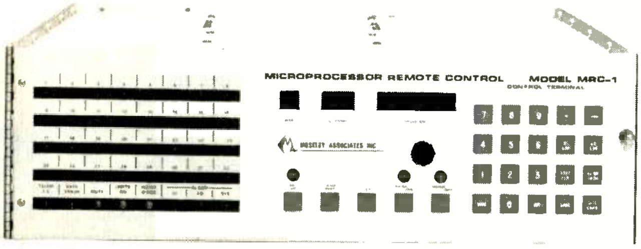


MRC-2

- MULTI-REMOTE AND MULTI-COMMAND SITE CAPABILITY
- MULTIPLE TRANSMISSION CHANNELS
- USER DEFINED SOFTWARE
- CLEAR ENGLISH DISPLAY

Leading Moseley's ever-growing family of microprocessor-based remote and supervisory control systems, the MRC-2 offers the user the most flexible and complete method of controlling and monitoring up to 99 remote sites available. With dual data link capability, 32 control lines, 32 status, and 32 telemetry channels standard; expansion capabilities allow for up to six data links, up to 255 control lines, and 255 status and 255 telemetry channels. User-defined dual upper and dual lower telemetry limits alarm when exceeded. Status channels can be programmed to alarm on rising, falling, or rising and falling waveforms. The MRC-2 offers a choice of six calibration modes for telemetry inputs; all setup data is preserved in non-volatile memory. Multiple CRTs, Loggers, and Automatic Control Units for automatic transmitter operation are available at both command and remote terminals.



MRC-1

- MULTIPLE REMOTE SITE CAPABILITY
- AUTOMATIC TELEMETRY MUTING
- USER DEFINED SYSTEM SETUP
- UP TO 64 COMMAND LINES PER SITE

Closely following the MRC-2 in performance, Moseley's MRC-1 is the leading Microprocessor Control System in the industry today. Up to 64 command outputs at each of up to nine remote terminals gives the user outstanding system flexibility. System setup is tailored by the individual user. Telemetry channels may be keyboard-calibrated for linear, indirect power, or direct power scaling. The MRC-1 features modular design, upper and lower telemetry limits, automatic telemetry muting, and a set of 32 LEDs that display all status inputs from any site simultaneously. In case of extended shutdown, the Moseley Memory Option stores setup data for up to ten years. Optional CRT and Logging terminals simplify operator interface with the MRC-1. The Multiple Direct Command options offers ten preselected command functions to give the operator quick control of critical parameters at any site.

For further information please contact our Marketing Department.

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tape deck, camera and battery pack, it is impossible for me to find a good reel-to-reel, battery-operated audiotape deck. Why? Obviously, the technology exists to build a 6-in audio mixer and 7½-inch reel-to-reel deck with EQ and limiting into a battery-operated unit. This could be in a backpack, but we would not have to be so limited. Why not use a small hand truck or dolly? Think of the many local events that could be covered unobtrusively with a good mobile audio deck and some rugged mics.

My contention is that the *technology* could exist, but the programmers/managers/engineers have not done their jobs in serving the public by demanding such equipment. Radio has copped out in the local production market. It is much easier for a program director or music director to sit in the office and read than it is to creatively plan local programming.

Radio remote pickups do not have to be *live* 60-second spots for the local advertiser. If you look at the incredible amount of post-production work that goes into every TV newscast, it becomes ludicrous that local radio is not using a lot of local tape. And, local radio stations should also have SMPTE time code synchronized editors to keep their local programming sounding professional and enjoyable. Remember, radio is still *show business.*

I would like to see radio broadcasters and equipment manufacturers benefit from the potential of local tape-recorded productions. And, there is another point worth noting. There is no reason why locally produced radio programming has to be free public affairs material. It can, and should, be sponsored.

Gerard Kaufhold
Engineer
WHIO Radio
Dayton, OH

You seem to be correct in stating that there is no portable audio mixer/recorder combo unit available that uses reel-to-reel recording and offers six inputs. In fact, the reel-to-reel portable recorder format has not been particularly popular because of its size. Such a machine does exist, however, with limited inputs. The well-known Nagra recording system, originally developed for the Hillary and Norgay conquest of Mount Everest (1953), is widely used for remote recording in film-making. Sony and Stellavox also market portable reel-to-reel machines. Line and mic inputs are provided. One Stellavox system offers phantom mic powering.

A wide variety of battery-powered audio mixers are available from Audio Developments, EELA Audio, Electro-

Voice, HME Electronics, Interface Electronics, Logitek, Micro-Trak, Neve, Panasonic/RAMSA, Ramko, RTS Systems, Russco, SATT Electronics, Sennheiser, Shure, Sony, Stellavox and Studer, among others. Mixers from these companies, all available through US distributors, generally include EQ, and many also provide for effects, limiting and other enhancements. Most were designed for use with portable recorders, operate on internal batteries or a 12Vdc supply, and can be carried easily by one person. Many of them would be ideally suited for the RENG van.

Although we appreciate your interest in reel-to-reel equipment, don't forget that the quality of cassette systems has greatly improved from early RENG efforts, when cheap cassette recorders were often provided for radio reporters. Of interest, perhaps, is one model from TASCAM/TEAC that includes a modular mixer and a cassette recorder/player.

Brinkley/KFKB

I am seeking information from your readers about the two attempts to win the Kansas governorship in 1930 and 1932 by the late Dr. John R. Brinkley, then of Milford, KS, which is west of Manhattan, KS. He entered late in 1930 as an Independent write-in candidate. In 1932, he was listed on the ballot as an Independent and he ran a strong race. He used his radio station (KFKB, Milford) talent, a truck wired for sound with a microphone, and a speaker's platform. (KFKB was referred to as Kansas First, Kansas Best.)

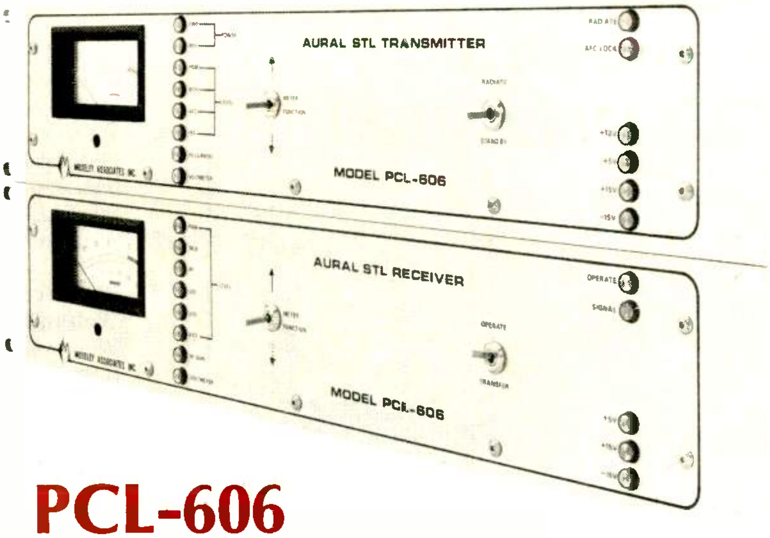
Francis W. Schruben
Professor of history
Pierce College

Kenneth Davis, in his book, ***Kansas—A Bicentennial History*** *(W. W. Norton, New York, 1976), records that Brinkley was a quack doctor who turned to politics and was strongly opposed by the* ***Kansas City Star.*** *As noted, he founded the second broadcast station in Kansas and used its communications power extensively. Readers interested in history and broadcasting may write to Professor Schruben at 6201 Winnetka Ave., Woodland Hills, CA 91371.*

The first station

For many years now, I have heard remarks at technical gatherings and have seen articles in technical publications about radio station KDKA, Pittsburgh, being the first station. In the past I have ignored the statements, but I must be getting crotchety in my old age because I want to see justice done.

Continued on page 259



#1 PERFORMER

PCL-606 and PCL-606/C

- ULTRA LOW NOISE AND DISTORTION
- EXCELLENT SELECTIVITY
- OUTSTANDING FREQUENCY STABILITY

Topping the Moseley line of aural studio-transmitter links, the PCL-606 and PCL-606/C are tailor-made for the broadcaster who demands the very finest in performance and engineering. Extremely congested, high-density RF environments are no problem for broadcasters using these all-new, state-of-the-art systems. Either the monaural (PCL-606) or stereo composite (PCL-606/C) provide today's broadcaster with the highest quality program interconnect available in an aural STL. Both are designed for maximum performance and reliability, with easy service features to minimize maintenance down time.

The dynamic range of both systems can be optimized as a function of signal strength, by a pin diode attenuator circuit in the receiver. Superior frequency stability is achieved in the PCL-606 and PCL-606/C Transmitters by locking phase and frequency to a synthesized AFC. Ultra-phase linear I.F. filters, and a broadband, extended digital demodulator provide surprisingly low noise and distortion, while the balance between distortion and selectivity can be tailored to user needs by adjusting I.F. bandwidth. A compensated, linear, baseband response maximizes both monaural and stereo transmission. Both the PCL-606 and PCL-606/C have switch-selectable signal metering functions to measure the incoming RF signal over its entire range. Internal system performance metering functions are built into both transmitter and receiver. All normal service adjustments are easily accessible through the top cover, and brass-enclosed module construction makes PC board servicing easier than ever. Should there be a failure or abnormality shutdown; the receiver is equipped to switch internally and automatically to a standby unit for continuous performance.

Continuing the legacy of the PCL-505, the FCL-606 and PCL-606/C are revolutionizing the state of the art in the aural STL marketplace.

- SELECTABLE IF BANDWIDTH
- BUILT-IN DIAGNOSTIC METERING

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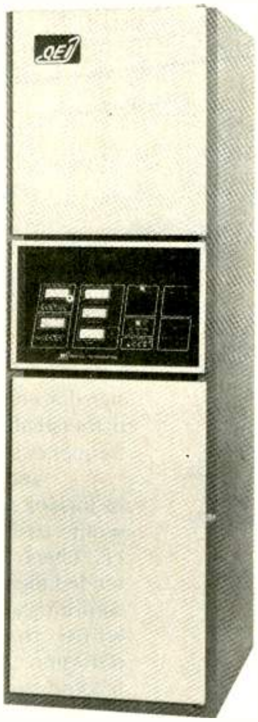

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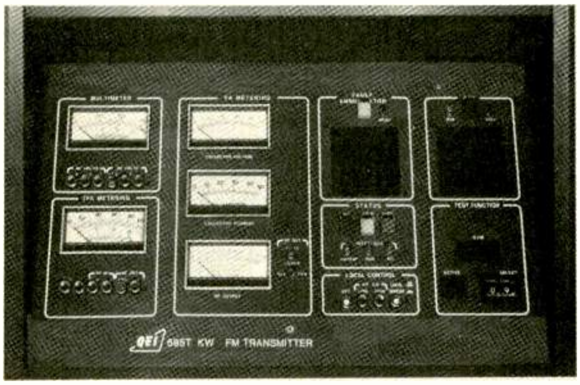

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people

John M. Sherman, director of engineering for WCCO, Minneapolis/St. Paul, from 1952 until his retirement in 1974, died recently after a lengthy illness. Before joining WCCO in 1936, Sherman was a field engineer for the Federal Radio Commission, later to become the FCC. He became district inspector-in-charge and remained with the FCC until 1936. Sherman received the Distinguished Service Award from the NAB in 1971.

Finntek Ltd. has announced the appointment of **John W. Welland** as president and director of engineering. Welland has formerly been associated with Spectra Computer Systems, Quanta Corporation and Convergence Corporation.

Jack Niebell has joined Dynair Electronics as vice president, engineering. He takes over this position from Hank Maynard, who has been promoted to vice president of operations. Niebell was previously with the 3M Company, where he held managerial positions in engineering and quality assurance since 1964.

Daniel D. Roberts has been named vice president of the Professional Video Division, US JVC Corporation. Roberts, who has been division manager since 1981, will continue to direct product development and marketing in addition to expanded administrative responsibilities.

Fred Zimmermann has been named president of Moseley Associates. Zimmermann joined the company in 1968 and, before being appointed vice president and general manager earlier this year, was vice president of customer services. The company also appointed **Kinsley Jones** as manager, US sales, and **Harry Wareham** as operations manager. Jones and his staff will be responsible for non-OEM sales. Wareham brings to the company more than 20 years of manufacturing and operations experience. He will work in the Goleta, CA, facility and be responsible for material control, fabrication, assembly and final testing.

Francois Olibet has been named president of Videodial, the US subsidiary of Telesystemes. Olibet was most recently director of the technical and business marketing department.

Rodney K. Madsen has joined Cetec Corporation as a corporate vice president. He accepted the Cetec position after two years as president of Gary Safe Company, and 14 years in engineering and management positions with Emerson Electric Company.

Donald F. Bogue has been appointed director of business management for Ampex Corporation's Magnetic Tape Division. Bogue will have responsibility for audio, video and instrumentation tape marketing and product line strategy, and for strengthening the business management of the company's magnetic tape business worldwide.

McMartin Industries has announced the appointment of **Richard Moen** as general sales manager. Moen will also continue his former responsiblities as Eastern regional sales manager. Other appointments include the following: **Terry Sheffield,** Western regional sales manager; **Don Jones,** Southern regional sales manager; and **Don Denver,** Central regional sales manager.

new literature

Broadcast TV filters

A 16-page catalog, *BTV/82*, from *Microwave Filter International Ltd.*, features filters, traps and channel combiners designed to eliminate interference in broadcast TV systems and to combine several transmitters into one antenna.

Circle (484) on Reply Card

Microminiature package

Signetics Corporation's new brochure, *SO Microminiature Packages*, details technical information and broad product availability of its Small Outline package. The brochure catalogs about 200 available products in the small packaging in three major lines: TTL Logic, Linear and LOCMOS 4000 series. Comparisons of the SO package to the standard DIP are included.

Circle (485) on Reply Card

TV resolution specs

A technical note from the *Visual Information Institute*, *The Reality of TV Resolution Specifications*, discusses vertical and horizontal resolution in displays, cameras and video processing equipment. Photographs, charts, graphs and schematics help illustrate the discussion.

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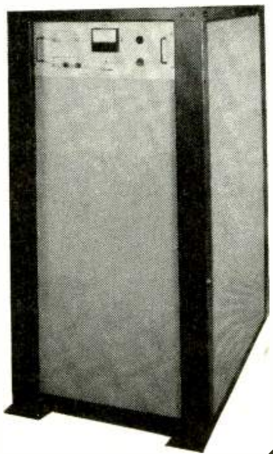
☐ No SCR's



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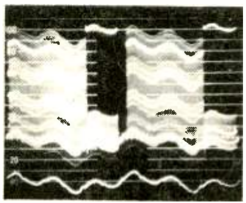
Will ELIMINATE HUM and other INTERFERENCE in Video Lines caused by differences in Ground Potential.



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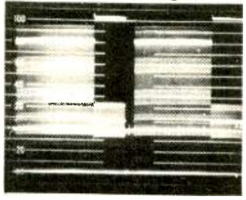

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Circle (184) on Reply Card

Teleconferencing

A new publication from the *University of Wisconsin-Extension Division* is titled *Teleconferencing and Electronic Communications.* The subtitle, *Applications, Technologies and Human Factors*, hints at the scope of more than 60 papers presented in this 448-page volume. Grouping of the articles includes sections on audio and video teleconferencing case studies; technologies and system design; Picturephone meeting service (Bell Labs); system planning, implementation and marketing; human factors; training and program design; evaluation of use, value and effectiveness; and videodisc and computer-based systems.

As the introduction points out, teleconferencing is a means of reducing expenses for 50% to 60% of all meetings. Whether the need is for 1- or 2-way facilities, the volume includes basics of lighting, camera and microphone placement and other suggestions to make a teleconferencing effort successful. The 18 case studies are particularly valuable to those considering how such an interconnection can be of value in different settings and subject areas. Cost of the book is $25 for the 8½"x11" paperback volume.

Circle (481) on Reply Card

Multichannel TV sound

The 2-volume *Electronic Industries Association Multichannel Sound Subcommittee Report* contains information regarding transmission standards for multichannel TV sound. Data on sound systems from the Electronic Industries Association of Japan, Telesonics Systems and Zenith Radio Corporation are featured. These systems are capable of transmitting stereo, a separate audio program and an auxiliary service multiplexed on the aural carrier.

Volume 1 contains all essential information, while Volume 2 contains test data, studies and background information. Copies of Volume 1 are complimentary.

Circle (482) on Reply Card

Power meter calibrator

A 12-page brochure from *Weinschel Engineering* describes the System II automatic power meter calibrator. The brochure presents a full introduction of automatic calibration of RF power meter/mount combinations operating in the 0.01 to 18GHz range. Every unit of the system is described, and a block diagram of the system is presented.

Circle (483) on Reply Card

Home satellites

The Home Satellite TV Book: How to Put The World in Your Backyard, by Anthony T. Easton, is a guide to buying, building and operating for profit your own home satellite TV receiving station. The book shows how to put together a receiving system for your home and how to operate it; where to buy equipment and what to look for; and what's up there on the "bird"—all in non-technical terms.

Circle (487) on Reply Card

MROs

The *Beckman Electronic Technologies 1982 MRO Short Form Catalog* lists all standard electronic components and test instruments for MRO dealers. It features pictures, descriptions and specifications of the following component and test instruments: cermet trimming potentiometers, precision potentiometers, turns-counting dials, liquid crystal displays, planar gas discharge, thick film resistor networks, thin film resistor networks and digital multimeters.

Circle (488) on Reply Card

High power amp

In a 14-page brochure, *Varian Associates* describes its Generation II VZJ-2700G series klystron high power amplifiers (KPAs). The literature discusses the major functional sections the GEN II KPA, including the power supply, RF assembly and the controls/monitors/logic section. In addition to a complete list of specifications, the brochure describes optional features, such as the computer interface card, which provides unattended computer control of the GEN II KPA.

Circle (489) on Reply Card

Spectrum analyzer

A 52-page technical brochure on its network/spectrum analyzer, model MS420A for audio, video and HF bands, is available from *Anritsu America*. In addition to general background and conclusion information, the literature includes data on basic measurement functions and measurement examples, personal test automation, bubble memory, GP-IB and application examples. Diagrams, charts and tables are contained in the material.

Circle (490) on Reply Card

Fiber-optic graphics

Artel Communications Corporation has produced a technical bulletin that describes the LS-100 fiber-optic computer graphics modem. This 3-color bulletin shows how fiber-optics are used to directly interconnect IBM 3250 graphics display control units over long distances with total noise immunity.

The bulletin also shows how fiber-optics increases work station separation, enhances communications security and eliminates noise and grounding problems. System block diagram details plug compatible coaxial-to-fiber modem interconnection, showing location of IBM 3258 and IBM 3255 control units. The bulletin also lists modem features such as remote loopback testing and on-line optical power level readings.

Circle (491) on Reply Card

Test instruments

The 48-page *BK-83* full-line test instrument catalog from the *B&K-Precision Product Group of Dynascan Corporation* describes oscilloscopes, signature analyzers, logic analyzers, lab-power supplies, DMMs, analog multimeters, digital logic and pulser probes, a temperature probe, a semiconductor curve tracer and accessory items. Product descriptions include detailed specification sections and suggested popular applications.

Circle (492) on Reply Card

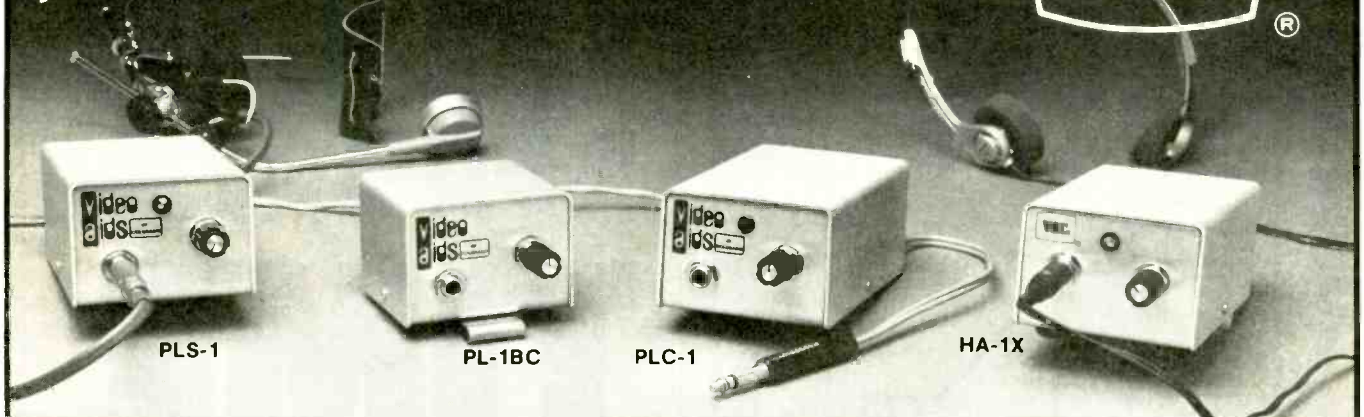
Cables and connectors

Belden Corporation's Electronic Division has published an illustrated 28-page flat cable and connector systems catalog. Construction details, such as physical specifications and electrical characteristics, are provided for each cable and connector in conventional and metric units. The catalog indicates compliance with applicable UL, CSA and related requirements.

Circle (493) on Reply Card

Audio Aids from VIDEO AIDS

VAC®



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Program audio where and when you need it. Amplifies low level stereo tuner to loud listening levels with 30 db maximum gain. Works with headphone impedances of 8 to 2000 ohms.

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MEDIUM WAVE
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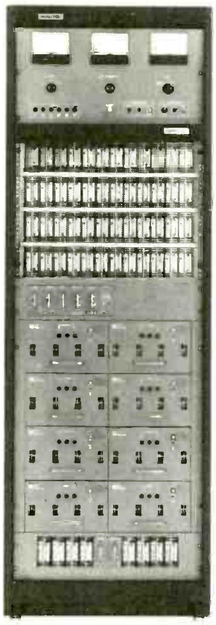
broadcast transmitters.



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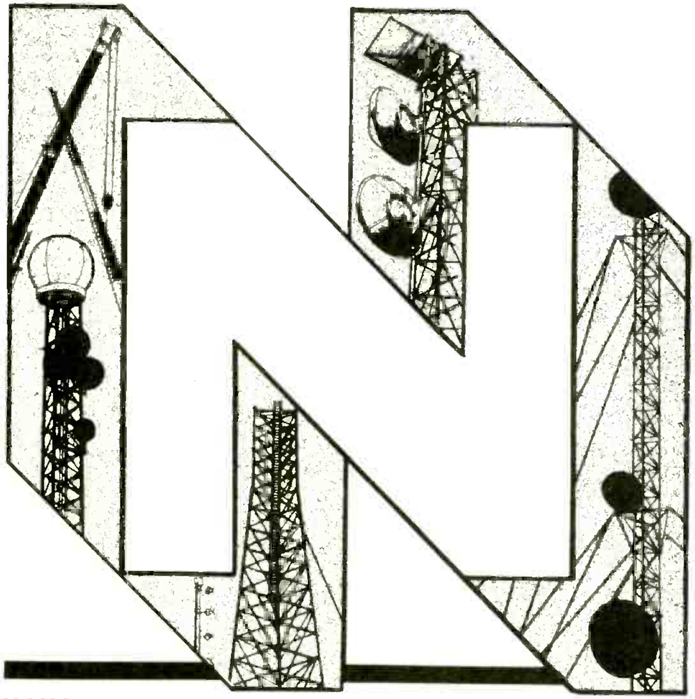

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Oscilloscope primer

The XYZs of Using a Scope is the title of a new primer on oscilloscope technology from *Tektronix*. The 36-page primer is divided into two parts. Part I includes chapters 1-5, covering scopes, controls and probes; Part II includes chapters 6-10, covering techniques of measurements with scopes.

Chapter titles are as follows: 1, "The Display System"; 2, "The Vertical System"; 3, "The Horizontal System"; 4, "The Trigger System"; 5, "All About Probes"; 6, "Waveforms"; 7, "Safety"; 8, "Getting Started"; 9, "Measurement Techniques"; and 10, "Scope Performance." A 2-page index is appended so that you can easily locate key topics of interest.

Figures include 34 graphics and scope traces. One of these graphics is reproduced here to illustrate the type of graphic and caption included to communicate scope usage.

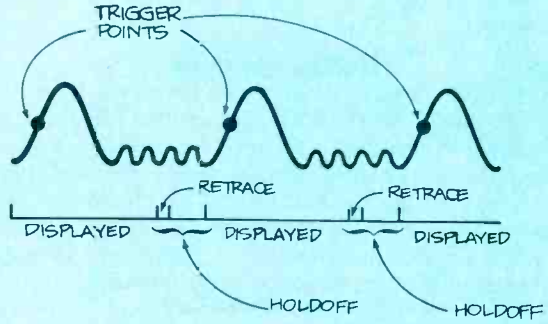

Figure 11.
TRIGGER HOLDOFF TIME ensures valid triggering. In the drawing only the labeled points start the display because no trigger can be recognized during the sweep or the retrace and holdoff period. The retrace and holdoff times are necessary because the electron beam must be returned to the left side of the screen after the sweep, and because the sweep generator needs reset time. The CRT Z axis is *blanked* between sweeps and *unblanked* during sweeps.

If you would like a free copy of this Tektronix scope primer, circle 494 on the reader service card, and we'll pass your request along to Tektronix.

SAVE TIME

For fast, accurate service, please remove the Peel-Off Label (which is used to address your magazine) and affix it to the Reader Service Card, the Address Change Card, or to any correspondence you send us regarding your subscription.

Feedback

Continued from page 253

In an article by Mike Palmer on audio switching systems in your March 1982 issue it is stated, "The first station, KDKA of Pittsburgh, began broadcasting in late 1920." The statement is wrong because KDKA is *not* the first station. It was the first station to receive a license from the FCC, but it was *not* the first station on the air.

Radio Station KCBS is the descendant of the first station to transmit material to all who could receive the signal. The history of Dr. Herrold's station follows.

KCBS Newsradio 74, the 50kW CBS-owned station in San Francisco, is the direct descendant of a small 15W spark transmitter developed by Charles David Herrold, principal of the Herrold College of Engineering and Wireless, which broadcast successfully for the first time in January 1909.

Broadcast, by definition, means "to cast in all directions," and that, in contrast to point-to-point wireless communication, is what Professor Herrold pioneered in 1909 to give KCBS its historical claim of being the world's first broadcasting station.

It became a "commercial" outlet on January 15, 1926, when the Sperry Flour Company bought a 15-minute cooking program five days a week, although small local merchants had used the station before this date.

The station's first broadcasts occurred more than three years before Congress enacted the Radio Act of 1912, which required licenses and call letters from "voice transmitter." Until this time, Herrold's operators simply announced, "This is San Jose calling," gave a vocational school identification, and went into their news and music. Operating the station continuously was a logical way for him to obtain publicity for his wireless school among an audience most likely to enroll—the teenage amateurs. Early equipment used included water-cooled microphones.

In 1921, after licenses were finally issued under the classification of broadcasting, Herrold's station became KQW. The call letters were changed to KCBS in 1949.

Herrold's 15W transmitter was boosted to 500W of power in 1925 and sold to the First Baptist Church in San Jose, CA. Fred J. Hart operated the station and a year later purchased it. Power was increased to 1kW in 1934 when Hart sold the station to Ralph Brunton and C.L. McCarthy. In a year, power was once more stepped up—this time to 5kW.

CBS took over in 1949 with Arthur Hull Hayes, who was then the first general manager and later became the president of CBS Radio. Power was boosted to its present 50kW in 1951.

The KCBS files are filled with documents which authenticate the pioneering accomplishments of Herrold. They include a transcript of a talk by another "father of radio," the late inventor Dr. Lee DeForrest. He was on the scene, and addressing a banquet of the Veteran Wireless Operators Association in 1940, he said: "My earliest broadcasting began here on the Pacific Coast...Pioneering station KQW at San Jose maintained regular transmissions...That station, KQW, can rightfully claim to be the oldest broadcasting station in the entire world..."

In 1959, Professor Gordon B. Greb of San Jose State College wrote an extensively researched and documented article for the *Journal of Broadcasting* which unequivocally established the claim of KCBS as the nation's original station. In the article, Greb said: "KDKA, as well as WHA, Madison, WI, and WWJ, Detroit, MI, have all claimed to be the first stations. Each has a claim to a first of some kind or other, and KDKA's claim is that it was

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the first station to be licensed under the federal regulations in 1920. The regulations required the licensing of the stations by the federal government, and KDKA acquired the first federal license issued by the Dept. of Commerce. That is its claim to fame. But, as to which station actually was the first to go on the air and broadcast, it was Herrold's station in San Jose, CA (now KCBS, San Francisco), which was on the air so early there were no regulations to govern it."

Also, the then US Senator Thomas Kuchel, on March 20, 1959, entered into The Congressional Record a treatise supporting KCBS' claim as the first in the nation.

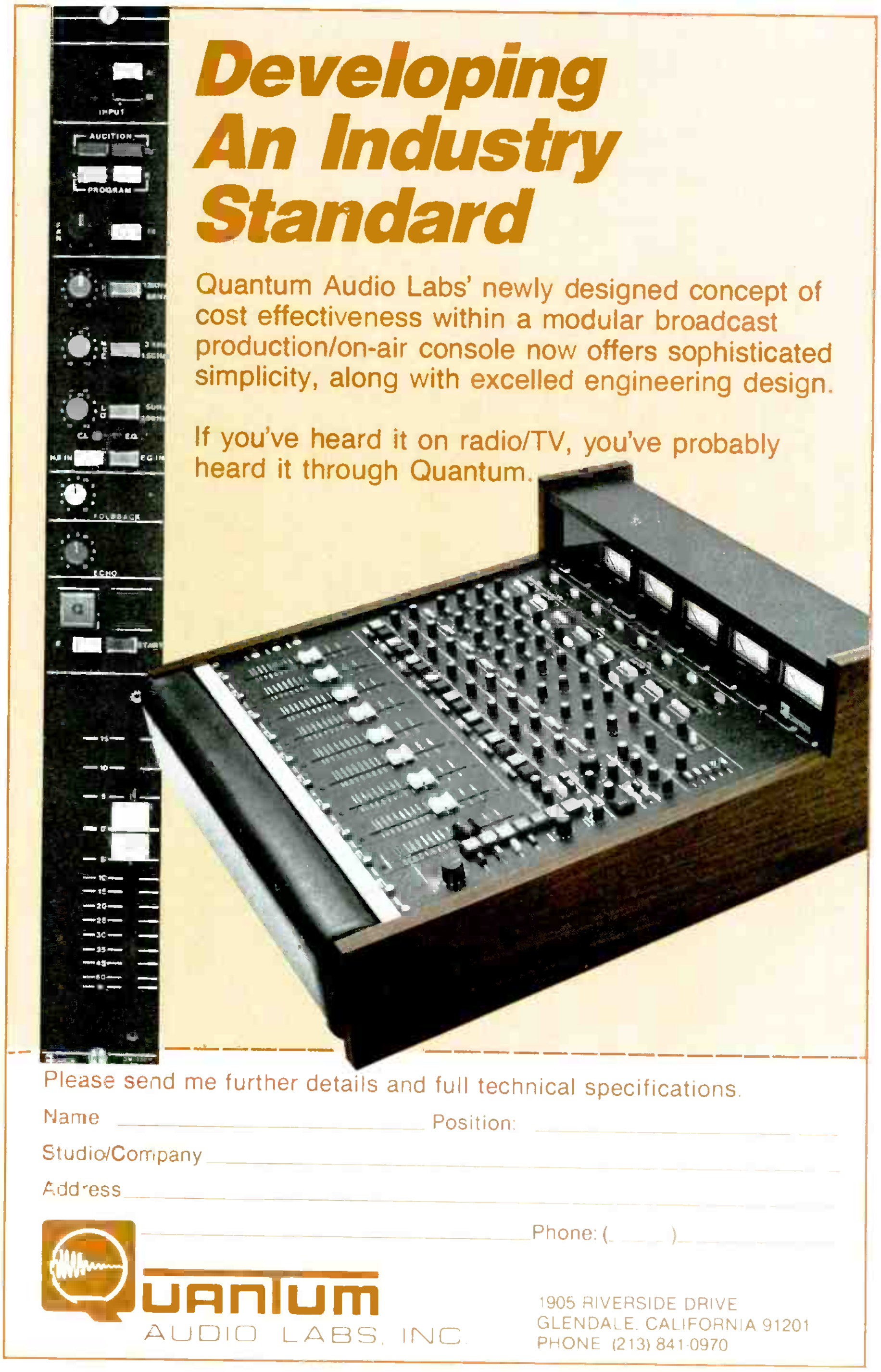
In 1968, KCBS became the first all-news station in Northern California. In 1973, the station was honored with the Golden Mike Award of the Broadcast Pioneers.

In November of 1976, the Native Sons of the Golden West presented KCBS with a bronze plaque honoring it as a Historical Landmark in California history.

Howie Immekus
Director of Technical and
Broadcast Operations
KCBS
San Francisco, CA

Caption contest

Each year at the NAB convention we select a photo or two for our readers to caption—all for fun, of course. Here are this year's entries. Readers can mail their humorous captions to the Humor Editor, **Broadcast Engineering**, P.O. Box 12901, Overland Park, KS 66212. We'll select the most humorous captions from the entries, publish them in a future issue, and award something interesting to the winning contestants. (For last year's winner, see our March issue, page 18.)



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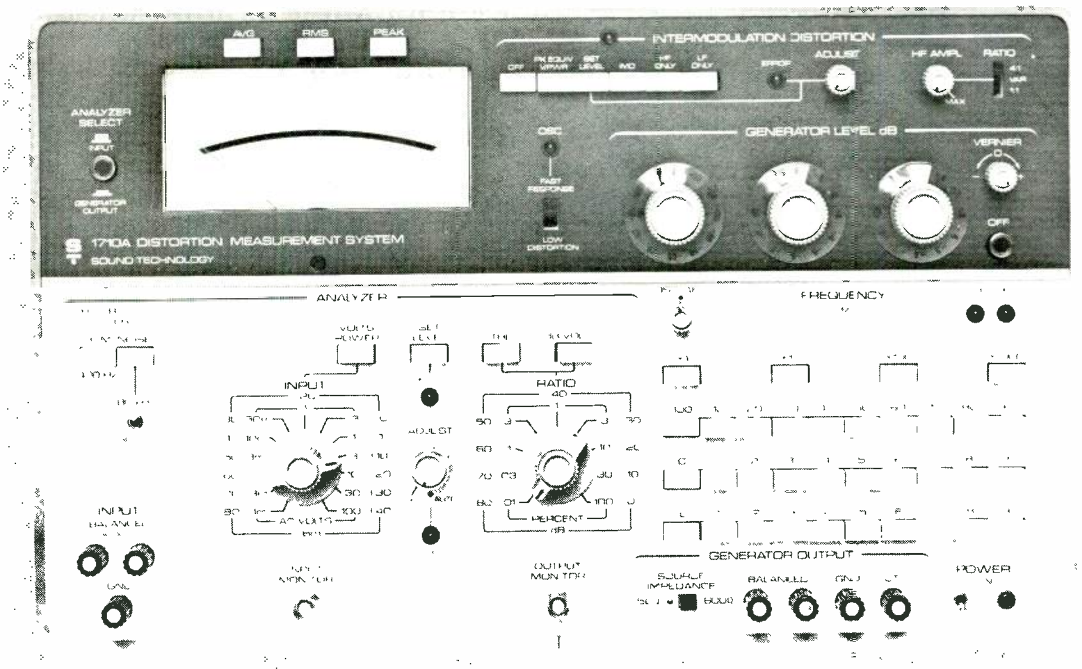
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USED BROADCAST TELEVISION EQUIPMENT. Hundreds of pieces wanted and for sale. Please call System Associates to receive our free flyer of equipment listings. (213) 641-2042. 1-82-12t

USED VIDEO EQUIPMENT: REBUILT AMPEX & MICROTIME TBCs, Tektronix waveform monitors 529; Teac model 5 audio mixer, 8 channel in 4 out x2 with slate & talkback; Microtime Image Plus unit, CBS Chroma keyer (encoded); Sony Multi-standard PVM-1850PS Color Pal/secam, NTSC; Philips Norelco PC-70 cameras/shotgun Angeniux lenses; Crosspoint Latch Suitcase switcher Model 6104A; Character Generator. Call 212-489-5210. 8-82-2t

WANTED TO BUY

WANTED: Pre-1928 radio equipment and tubes. August J. Link, Surcom Associates, 305 Wisconsin Ave., Oceanside, CA 92054, (714) 722-6162. 3-76-tf

HIGHEST PRICES PAID for 112 Phase Monitors and for clean, 12 year old or less, 1 KW and 10 KW AM Transmitters. All duty and transportation paid. Surplus Equipment Sales, 2 Thorncliffe Park Dr., Unit 28, Toronto, Canada M4H 1H2, 416-421-5631. 2-79-tfn

INSTANT CASH FOR TV EQUIPMENT: Urgently need transmitters, antennas, towers, cameras, VTRs, color studio equipment. Call toll free 800-241-7878. Bill Kitchen, Quality Media Corporation (in Georgia call 404-324-1271). 6-79-tfn

WANTED: STATION LIBRARIE'S OF MUSIC, 16" ET's, 12" Transcriptions, 45's, 78's, LP's. Boyd Robeson, 2425 W. Maple, Wichita, KS 67213, (316) 942-3673, 722-7765. 5-82-tfn

INSTANT CASH FOR BROADCAST EQUIPMENT: Urgently need good used: Transmitters, AM-FM-TV, Film Chains, Audio Consoles, Audio-Video Recorders, Microwave; Towers; WX Radar; Color Studio Equipment. Ray LaRue or Bill Kitchen, Quality Media Corp., (404) 324-1271. 9-82-1t

$500 REWARD FOR UHF TRANSMITTERS: For information which leads to our purchase of any UHF TV Transmitter. Call Ray LaRue or Bill Kitchen (404) 324-1271. 9-82-1t

CHRISTIAN MISSIONARY ORGANIZATION needs help with equipment for ¾ ENG/EFP. Donations deductible. Crown Productions, Box YWAM, Kailuakona, HI 96740. 8-82-2t

WANTED: Tape cartridge winder, RCA p/n MI-592378, for TCR-100. Call Jim Barber 404-897-7424. 9-82-2t

EMPLOYMENT SERVICES

PROFESSIONAL RESUME SERVICES, 1125 South Cedar Crest Boulevard, Allentown, Pennsylvania 18103. Resume preparation for broadcast engineering professionals. Call or collect or write. (215) 433-4112. 9-82-1t

HELP WANTED

GMI

STUDIO ENGINEER

IMMEDIATE OPENING FOR TELEVISION STUDIO ENGINEER Must maintain and repair television production equipment, including 3/4" VCR's, 1/2" VHS recorders, ENG camera equipment, video switchers, audio systems, dubbing systems, etc. Operate equipment in support of productions Two years experience in video or communications field preferred. FCC 1st Class Radio Telephone Commercial License desirable. Send resume, including personal, educational and professional background by October 1, 1982 to:

Pamela Y Loving
Personnel Director
GMI Engineering & Management Institute
1700 W. Third Avenue
Flint, MI 48502-2276

GMI is an Equal Opportunity/Affirmative Action Employer

HELP WANTED

TELEMATION PRODUCTIONS Unit 4 is in need of a Remote Maintenance Engineer with experience in Ikegami cameras, Ampex & Sony 1" tape, Chyron, Ross & Utah switching, and more. Must be a self-starter. Contact: John Gebhard, Chief Engineer, Telemation Productions, 3210 W. Westlake Avenue, Glenview, Illinois 60025. 312/729-5215. 8-82-2t

TELEMATION PRODUCTIONS, a full service production company with offices in Chicago, Denver, and Seattle needs an experienced Maintenance Engineer at our Chicago facility. Equipment includes Ampex & Sony VTR's, RCA & Ikegami cameras, Ampex ADO, Vital Squeezoom, Computer Editing, Vital & Ross switching, and much more. Interested persons should contact: John Gebhard, Chief Engineer, Telemation Productions, 3210 W. Westlake Avenue, Glenview, Illinois 60025. 312/729-5215. 8-82-2t

ENGINEERING POSITIONS
($15,000.00 - $60,000.00)

We specialize in the placement of TECHNICAL ENGINEERS with TV Stations, Groups, Networks, Satellite Programmers, Production Facilities, Corporate and Industrial TV, Mfrs and CATV. All levels and positions: Director, Chief, Asst. Chief, Studio Supervisor, Maintenance and Technical. (Our service does not include operational or program personnel). All locations nationwide. Employers pay all fees - Confidential, Professional. Over $4,000,000.00 in Salaried Positions Placed. Employee and Employer inquiries invited.

Phone/Resume - ALAN KORNISH
(717) 287-9635

Key Systems
106 New Bridge Center-Kingston, Pa. 18704

MAJOR EAST COAST PRODUCTION FACILITY has openings in the following areas: 1. Video (location, remote unit, and studio). 2. Film Color Correction (Rank Mark III experience preferred). 3. Editors (CMX340X/GVG EMEM experience preferred). 4. Top maintenance personnel. Satisfactory applicants must be client-oriented, self-starters. Competitive salaries and excellent benefits package. Send resume in confidence to Dept. 573, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 9-82-2t

$ OPPORTUNITY—FUTURE GROWTH: AGGRESSIVE MANUFACTURING COMPANY is seeking an experienced salesman in the telecommunications industry. Our product line includes Simulsat, the most advanced multi-beam satellite antenna known today. Excellent salary and benefits package. Send resume to: Lloyd Bonner, Antenna Technology Corporation, 1042 East Camelback Road, Phoenix, Arizona 85014. 9-82-1t

WNEV-TV IS SEEKING ENGINEERING PROFESSIONALS. ENGINEERING SUPERVISORS: Must be progressive manager and have knowledge of state-of-the-art ENG operations. Supervisory experience necessary. MAINTENANCE TECHNICIAN: For new ½ inch component format. ENG/EFP maintenance experience desired. Send resume to WNEV-TV, 7 Bulfinch Place, Boston, MA 02114. An Equal Opportunity Employer. 9-82-1t

STATE-OF-THE-ART AOR FM Radio engineer wanted to maintain new FM. Seeking engineer who demands best signal in town from his equipment! Hands on maintenance. Mature experienced veterans encouraged. Top Salary. Dept. 571. Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 9-82-2t

HELP WANTED (CONT.)

ASSISTANT TO THE CHIEF ENGINEER—Telecommunications Division needs Assistant to the Chief Engineer with FCC 1st or General license. SBE classification a plus. Work with state-of-the-art radio, TV and satellite facility at West Windsor, N.J. campus, including public radio station WWFM, Mercer County Community College cable TV network, closed circuit TV and radio/TV academic programs. Requires maintenance and construction experience in radio and/or TV. BA or AA degree desirable. Salary dependent upon experience. Excellent fringe benefits. Respond with resume to: MERCER COUNTY COMMUNITY COLLEGE, Personnel Services, Dept. GS, P.O. Box B, Trenton, N.J. 08690. Equal Opportunity Employer M/F. 9-82-1t

CMX 340X CERTIFIED EDITOR, 22 years creative video/film experience. NBC, ABC, NASA. Brochure available from Don Canaan, 7295 Oakland Mills Road, Columbia, Maryland 21046. 9-82-1t

CORPORATE VIDEO STUDIO TECHNICIAN. Major Northeast corporation seeks video technician to maintain fully equipped corporate T.V. studio. Must understand Ikegami camera electronics and be able to repair Sony ¾-inch recorders. Starting Salary $18,000 or more depending on qualifications and experience. Excellent company benefits. Send resume of qualifications and salary requirements to American Can Company, American Lane, Greenwich, CT 06830. Att'n.: W.F. Panza. An equal opportunity/affirmative action employer. M/F. 9-82-1t

SYSTEM DESIGN ENGINEER—CCTV. Must be able to specify, design, supervise installation and de-bug top quality industrial CCTV systems. Experience required. SYSTEM ENGINEER—AUDIO VISUAL and PROFESSIONAL AUDIO Hands on experience with audio/visual equipment a must. Digital knowledge helpful but not required. Responsibilities include complete job oversee and client interface. Both positions provide paid health, life insurance, vacation, etc. Please call collect 201-288-6130, Stylist Systems, Teterboro, N.J. 9-81-tfn

BROADCAST EQUIPMENT SALES MANUFACTURERS REPRESENTATIVE

A major U.S. manufacturer of audio broadcast equipment requires representatives for the New York and Los Angeles areas. Candidates must have solid experience in broadcast equipment sales, be self-motivated and willing to spend some time on the road. Salary, expenses, and commission plus company benefits furnished.

Please reply in confidence

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With our recently developed 24-hour all news cable service, Group W Satellite Communications, a division of Westinghouse Broadcasting and Cable Company is fast becoming a recognized cable industry leader.

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Located in an extraordinary waterfront location convenient to New York City, GWSC provides a highly supportive environment that recognizes talent and rewards contributions. You'll also receive competitive salaries and generous fringe benefits. For prompt consideration, please forward resume and salary history, in confidence to:
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Manager, Technical Operations

GROUP W
Satellite Communications
41 Harbor Plaza Drive
P.O. Box 10210
Stamford, Connecticut 06904

An Equal Opportunity Employer m/f

HELP WANTED (CONT.)

CHIEF ENGINEER
BOSTON FM/AM

WHUE has an opportunity for an experienced person with strong audio and transmitter background to take charge of technical operations of its Class B-50 kw FM and 5kw-DA2 AM Beautiful Music stations.

This is a "hands-on" position with plenty of opportunity and many exciting possibilities. If you can keep us the best sounding stations in Boston, you will receive strong management support, an excellent compensation package and the kind of atmosphere you need to do the job right.

Send resume, references, salary history, or call A. M. Tanger, President, during business hours at (617) 267-0123.

Beautiful music WHUE 101 FM AM 1150

200 Clarendon Street
Boston, Massachusetts 02116
Equal Opportunity Employer

SOUTHEAST MICHIGAN AM-FM is seeking an assistant chief. Applicant must have a minimum of two years of technical school plus three years of experience and valid FCC license. SBE certification a plus. EOE. Send resume & references to: Dept. 570, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 7-82-3t

ELECTRONICS ENGINEER – NATIONAL PUBLIC RADIO seeks electronics maintenance engineers with 3 years experience in servicing audio equipment. Selected applicants will be trained in the maintenance of our broadcast facilities. Opportunity for growth and experience. General or FCC 1st Class Radio-Telephone Operators License desirable. Excellent benefits – Salary negotiable. Send resumes and salary history to: National Public Radio, Personnel 2025 M Street, N.W., Washington, D.C. 20036. 9-82-1t

"HANDS-ON" CHIEF ENGINEER – Maintain transmission system (baseband processing, microwave, UHF TV transmitters, translator) in accord with FCC regulations and perform other duties required under Part 73.661. Some studio equipment maintenance. Participate in planning and construction of expanded production and master control facilities. Position requires a minimum of 5 years employment in operating, maintaining and repairing broadcast equipment including at least 1 year at a UHF facility. Experience with Klystron transmitters essential. Some management experience preferred. Excellent growth and advancement opportunity. Contact: H. D. Lung, V.P., KSCI, 1950 Cotner Avenue, West Los Angeles, CA 90025. (213) 479-8081. Equal Opportunity Employer. 9-82-2t

PRODUCTION DIRECTOR: With 3 to 5 years experience on switcher needed by Trinity Broadcasting, P.O. Box O, Oklahoma City, OK 73125. Call 405-848-1414. 9-82-1t

REQUEST FOR PROPOSAL

Research/Design of New FM Broadcast Antenna

KSOR-FM is soliciting proposals from firms experienced in research, design and construction in 88-108 MHz FM broadcast transmitting antennas. For specifications write:

Ronald Kramer, KSOR Radio
1250 Siskiyou Blvd.
Ashland, OR 97520

HELP WANTED (CONT.)

T.V. MAINTENANCE TECHNICIAN ENGINEER – Experience with Ampex 1200, 2000, AVR 1, NPR 2, RCA TK28 film chain. Send resume to Don Fox, Video Dub, Inc., 423 West 55th Street, New York, N.Y. 10019. 212-582-9550. 9-82-1t

VIDEO TECHNICIAN – MAINTENANCE & operation of on-campus CCTV, studio, and related television equipment. AAS in electronics preferred, minimum 3 years experience. Deadline Sept. 15, 1982. Send resume to: Dr. Joseph S. Gardiner, Director Instructional Resources Center, State University College, Oneonta, N.Y. 13820. An equal opportunity employer. 9-82-1t

MAINTENANCE ENGINEER FOR LARGE POST Production facility in Hollywood, Florida. Must have at least three years experience with one and two inch editing systems. 25K to start, full medical benefits. Call Greg Fox, 1-305-653-9200. 9-82-1t

ENGINEER: TELEVISION MAINTENANCE for college CCTV and broadcast quality production facility. Requirements: BSET or equivalent, 4-6 years experience. Send resume to Personnel Department, Rochester Institute of Technology, One Lomb Memorial Drive, P.O. Box 9887, Rochester, New York 14623. Equal Opportunity Employer. 9-82-2t

ASSISTANT CHIEF ENGINEER – Major Market. We are currently seeking a talented individual with a strong maintenance and supervisory background. We offer an excellent salary, good benefits, and room for advancement. Send resume to Earle Connors, Chief Engineer, WDSU-TV, 520 Royal Street, New Orleans, LA 70130. 9-82-2t

TRANSMITTER SUPERVISOR. Maintain 2 UHF transmitters in southwest Iowa. FCC license and 4 years' experience in maintaining TV transmitters. Salary range: $21,964.80-$27,539.20. Phone (515) 281-4498 for application materials. Contact: Personnel Office, Iowa Public Broadcasting Network, P.O. Box 1758, Des Moines, Iowa 50305. EOE M/F. 9-82-1t

CHIEF ENGINEER

Responsible for engineering leadership, identifying priorities, ensuring quality of facilities and techniques, and maintaining compliance with FCC rules. Will develop training procedures, assist budget preparation, and perform related technical leadership functions.

TV ENGINEERING SUPERVISOR

Supervise technicians in installation, maintenance, and operation of equipment in compliance with company engineering standards and FCC rules. At least 5 years' TV broadcast experience with ENG, digital background and FCC General License. Supervisory experience preferred.

Send resumes to WNEV-TV, Employee Relations Department, 7 Bulfinch Place, Government Center, Boston, MA 02114. No phone calls please.

An Equal Opportunity Employer

ASST. ENGINEERING MANAGER: Group-owned television station, offering best of all worlds for hard-working person interested in **Opportunity** and **Development**. Must have excellent systems knowledge, management ability, foresight, and a practical approach. Hands-on required. Location, climate, and benefits are a big plus. Contact: Tom Bradford, Cosmos Broadcasting Corp (WIS-TV), P.O. Box 367, Columbia, S.C. 29202, 803-799-1010. An Equal Opportunity Employer. 9-82-2t

TECHNICAL SUPERVISOR, 50K, AM DA. Looking for super tech, strong transmitter background, minimum 3 years broadcast maintenance experience. Must be self-starter, familiar with antenna, audio proofs, and state-of-the-art digital equipment. Need first, 2nd, or General FCC license. Send detailed resume/salary history to Eric Culp, Engineering Manager, WOWO, 203 West Wayne Street, Fort Wayne, IN 46802. No calls. EOE. 9-82-1t

HELP WANTED (CONT.)

BROADCAST GROUP SEEKING ENGINEER for AM and FM stations located in Central up-state New York. Applicant should be familiar with both A.F. and high power R.F. circuits. Should have First Class/General License, broadcast experience and references. Respond to Rust Communications Group, Inc., P.O. Box 1378, Leesburg, VA 22075. An Equal Opportunity Employer. 9-82-1t

ENGINEERS, TV Systems Engineers, Electronic Technicians, Technical Supervisors, Maintenance. Immediate openings. Experienced. Full time. Full benefits, plus Pension. Excellent salary plus commissions. Send resume to Technical Operations, Inc., P.O. Box 840, New Hyde Park, N.Y. 11040, or call Personnel Mgr. (516) 352-2238. 9-80-tfn

STATE-OF-THE-ART MAINTENANCE ENGINEER. Switchers, cameras, computer editing. Blue chip N.Y. Company seeks growth oriented self starter. Resume and salary requirements to: Tulchin Studios, 240 E. 45 St., New York, N.Y. 10017. Att: Al De Paul. 9-82-1t

TV ENGINEER: NEEDED FOR MAJOR UNIVERSITY production service. Responsible for the operation and maintenance of state-of-the-art broadcast quality equipment in new Telecommunications Center. Requires 2-year degree in electronics and at least two years relevant experience. Salary competitive, excellent fringe benefits. For complete job description write to: Marshall E. Allen, Educational Television Services, Oklahoma State University, Stillwater, Oklahoma 74078. 9-82-1t

TELEVISION – SALES

TECHNICAL SALES REP: A dynamic individual with T.V. Engineering and/or Production Experience and Sales Experience in the Southern California market area to join a success oriented SALES TEAM. Attractive salary, benefits and commission program. Send resume and salary history to Dept. 572, Broadcast Engineering, P.O. Box 12901, Overland Park, Kansas 66212. 9-82-1t

POSITION WANTED

BROADCAST ENGINEERING GRADUATE with F.C.C. License seeks entry level position. Joe Donato, Box 20113, Phila., PA 19145, (215) 389-4367. 8-82-2t

HIGHLY MOTIVATED, SELF STARTER with FCC 2nd ticket seeks entry level operations position. Steve Thompson, 112 East St., Excelsior Springs, MO 64024, 816-637-8885 evenings. 9-81-1t

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